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PRIZE ESSAY

ON

CHOLERA INFANTUM.

By JAMES STEWART, M. D.,

Author of "A Practical Treatise on the Diseases of Children."

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Si quid novisti rectius istis,  
Candidus imperti; si non, his utere mecum.

*Hor., Epist. vi. 67.*

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CHOLERA INFANTUM is usually regarded as a disease peculiar to the United States; and its appearance in the cities throughout our land is expected with as much certainty as is the season to which it owes its existence. With this certainty as to the time of its appearance, is to be added the uniformity it observes in its prevalence at a distinct period of life; both showing the unchangeable nature and uniform operation of the agents which are active in its production. No summer passes without leaving evidences of the power a season can exert over human life, and how remarkably that power is active in the development of a peculiar affection at a distinct period of existence.

Most endemic diseases attack indiscriminately at all ages; this one, as its name indicates, is confined to the tenderest age, while there is no disease that simulates it in its most marked characteristics at any other age. The kindred affection that has of late scourged so many countries, is uncertain as to the time of its invasion, and erratic in its course in different countries, yet apparently observes some law of pro-

gression ; while the cholera of infants never yet has failed to commit its ravages when the proper atmospheric condition for its development exists, and is as steadily fixed to its locality as any of the natural products of a climate. Such is the experience of American physicians, and it is by them alone that any description of the disease has been given.

It has been stated that a disease exists in England among infants, similar to that which has so much occupied the attention of practitioners in our country. If this be so, it must be vastly less in extent and virulence than the disease as it prevails in the United States ; for we find nothing in the way of description, but in its place, surmises that an infantile affection of the bowels existing there, is the same as that called cholera infantum. Had there been the same certainty of the annual return of the disease or any approximation to its mortality, there would not have been wanting numerous essays on so interesting a subject from the profession in Great Britain. It is also said that Dr. Cleghorn described among the diseases of Minorca, one similar to that which prevails so extensively here during the summer among infants ; if so, it would appear to prove that the like disease did not exist in Great Britain, or it would certainly have been noticed by the distinguished Dublin Professor, who was at one time an associate in London of those world-renowned observers, Fothergill, Cuming, and Russell.\*

French writers say that there is nothing analogous to this disease in France ; and when considering it in systematic works on children's diseases, give a description of it derived from American authors.†

In the absence, therefore, of testimony to the contrary, there seems to be some foundation for the opinion that it is peculiar to the United States.

\* See Appendix, A.

† "Cholera is not generally noticed in our climate ; it is a disease peculiar to infants in the United States ; and as I have not observed any thing analogous to this affection, I must be indebted to Dr. Dewees for the principal details of the symptoms."—*Billard on Infants. American edition, p. 328.*

In the course of our remarks on the nature of the disease, it will be seen that at a particular period of life an exaltation of certain functions will arise in the course of the natural development of the body, which often results in derangements of the alimentary canal. This action becoming aggravated, will bear a very close resemblance to the disease in question, especially in its first stage, yet still wanting some of its characteristic symptoms. These symptoms appear to be the result of the combined action of the different external causes of the disease, which constitute the physical conditions of a country in its relations to organic life. The presence of these agents is necessary to produce the disease in all its power: when they are absent, an imperfect development of it occurs, as is doubtless the case in the instances referred to above.

#### ETIOLOGY.

That a clear idea of the causes of this disease may be obtained, with a view to investigate its pathology and the strictly practical application of remedial measures, it is proposed to subject all the circumstances which are observed to control its development to a careful examination. There is no disease which appears to demand so close an investigation of this nature, for there is none which has its pathology so intimately connected with the action of the agencies which are in constant exercise in its production, and in its maintenance throughout its course. The combination of these active agents,—constituting what is known as climate, the more special local agents, and the physiological peculiarities of the period of life at which the disease occurs, it will be seen are all connected in the production and maintenance of the same pathological results, so formidable in their action, and so obstinate in their management. These circumstances are not to be regarded as mere isolated facts, but as an important group, which are essential, when connected with the phenomena of the disease and its morbid anatomy, to illustrate the morbid condition of the system: none of them can be separated

without impairing the relation they bear to the nature of the disease.

OBSERVATION 1st.—*Atmospheric Heat.*—The most common attendant on the development of the disease, is a high temperature.

In the city of New York, during a period of eleven years, out of twelve hundred and forty-five deaths from cholera infantum, ten hundred and sixty-one occurred during the months of July, August, and September, the three hottest months,—and but six during the three coldest.

The next highest in number as influenced by a high range of temperature, but which includes all ages, is dysentery.

The depression of temperature exhibits a difference also in its effects, but nothing in comparison with that caused by a high range. Thus croup presents the greatest difference from this cause, and of twelve hundred and thirteen deaths presents in no month less than sixty-six,—in the three summer months, two hundred and twenty, and in the three winter months no greater increase than three hundred and ninety-eight.\*

In the entire number reported, none shows so great a difference from temperature as the disease under consideration.

So uniformly has this disease existed in the city of New York during the hot months alone, that there is no year of which there is any record of diseases, that deaths from it are not reported as steadily increasing in number with the increase of temperature. For fifty years past, from 1804 to 1854, a large number of deaths has been officially reported from cholera infantum during the summer season, with the exception of one year, when there appears in the official register but one death from this cause. This occurred in the year 1816. On looking over the periodicals and newspapers of that year, it appears that the summer of 1816 was singularly cold, the thermometer up to the 25th of July being from 15° to 20° below the summer temperature, and after that period the mean temperature was but 61°—that, of the

\* See Appendix, B.

three months  $68^{\circ}$ ; a sudden elevation for a day or two raising the mean, while the actual continuation of the cold for the season was without a parallel.\* Cholera infantum appears scarcely to exist when the mean temperature is about  $60^{\circ}$ .

Although the mean is usually given as an evidence of the effect of temperature in producing disease, yet it is obvious that it is more correctly attributable to the diurnal range. The mean temperature of a week, can give but little information as to the effects of heat when the thermometer has been at or above  $90^{\circ}$ . The high temperature of  $95^{\circ}$  will produce serious and often suddenly fatal disease, while the mean of  $75^{\circ}$  could furnish no explanation.

The invasion of cholera infantum occurs immediately after a period of excessive heat, and is one of its most marked effects.

OBSERVATION 2d.—*Excessive humidity of the air.*—The condition of the atmosphere with respect to its humidity is one of the elements which imparts to a country its peculiarity as regards disease. There does not appear to be much difference in the annual mean in various parts of the northern section of our country, and the diseases incident to it present much the same characters. The humidity, however, is much modified, and often immoderately developed under the occasional changes which occur in the atmosphere; but more especially is it increased in circumscribed localities and in crowded dwellings.

The temperature at which moisture is deposited, is usually taken to ascertain the amount of moisture in the air. When the temperature of deposit, or as it is termed dew-point, is high, and especially when it continues high for some time in hot weather, the system feels its depressing influence. All persons suffer from a sensation of lassitude and sweltering oppression at such times; but no class equal to young children. During the sultry nights of summer, in the over-

\* See Appendix, C.



crowded habitations of the poor, they show the effects in their excessive pallor, languor, and exhaustion.

In our investigations on the subject of atmospheric humidity, and its relation to the disease under consideration, we have examined various localities, and found as was expected, that a great difference existed. As to the city of New York, we have carefully compared the observations made for the Smithsonian Institution by Prof. O. W. Morris, of the Deaf and Dumb Asylum, with those which we have taken; and have come to the conclusion that ordinary climatic humidity has but limited influence on the development of cholera infantum. The same amount of moisture often exists in country places as is found in the city, and where the disease was never known to originate. We therefore directed our attention to the occasional state of the dew-point as it occurred where the disease was most prevalent, and discovered a great difference within-doors, between it and the general dew-point of the external air, continuing often for a long time.

The first observation made was that the moisture was always greater nearer the surface of the earth; the difference we have ascertained to be at times  $4^{\circ}$ . Cellars and basements must therefore always be in a state of excessive humidity, as is known to most persons, requiring no philosophical instrument for its detection.

The second is that in very hot weather in excessively crowded houses at night, when all are within, the dew-point is very nearly at the temperature of the air, consequently the air is saturated with moisture. With a temperature of  $90^{\circ}$  to  $95^{\circ}$  and a dew-point in a crowded room almost equal to the temperature, a feeling of suffocation is experienced, which is easily accounted for when it is known that the dew-point of the breath as it is expelled from the lungs is  $94^{\circ}$ , and that the mean dew-point of the atmosphere is  $38^{\circ}$ ; and also, that in the hottest weather it rarely exceeds  $70^{\circ}$ . When the air is loaded with moisture and deposited easily at a temperature approaching to that of the living body, inspiration is difficult and unsatisfactory, while the system suffers great depression.

The effects will be again referred to, when the pathology of the disease is considered.

It is in such heated and moist places that we have found the greatest number of instances of cholera infantum.

OBSERVATION 3d.—*Malaria*.—This cause has been regarded as the principal agent in the production of cholera infantum; meaning by it an atmosphere infected by marsh effluvium. It is ascribed to this by some writers, and also by the Committee “On the Epidemics of Tennessee and Kentucky,” in their report to the American Medical Association in 1853. This report, and that made in 1854, are the most recent published remarks upon the subject. It would seem, however, more in accordance with well-known facts to consider the *malaria of crowded places*, as the kind of malaria which produces the disease. The report first referred to appears to admit this to a certain extent, as it speaks of the air of apartments that have been carefully closed at night to keep the external malaria excluded, as being the places where the medical practitioner is frequently called to see the disease.

Cholera infantum in some mitigated form may arise in the country, since it will appear in the course of this essay that many of its causes will exist in different places under the influence of a high range of temperature, and different grades will probably be found in places remote from each other. There is, however, so great a modification and so peculiar a type out of the cities as to make it more of a severe diarrhœa, complicated with fever, receiving its characteristic type from the condition of the air producing it, but differing much from the virulent disease as it occurs in cities.

Inasmuch as the usual cause of endemic fevers in the country has been regarded as the cause of this disease, a reference to the nature and source of the two kinds of malaria, with the mode in which their effects are manifested, will be necessary to exhibit them in their proper character, and by comparing them, endeavor to ascertain whether there exists any dissimilarity. This can be very briefly done by avoid-

ing the consideration of every thing that can complicate the inquiry, especially of all subjects connected with the discussion of the pathology of miasmatic diseases, and by keeping closely to the inquiry into their origin and their effects.

The malaria of the country is produced by emanations from marshy places, and by a dessication of the surface of the ground both by solar heat and by the passage of currents of air over it, carrying into the body of the atmosphere the minute gaseous results of vegetable decomposition. That which is exclusively of the city, it is obvious, cannot be produced in the same manner, the surface of the streets not admitting of such constant evaporation by the solar rays or by the passage of currents of air; indeed the absence of the sun's rays, and that also of the movements of the air, are always considered as the principal causes of the diseases that are peculiar to cities. If air from malarious districts is borne into the cities, it must be very considerably modified by the mixture with that which is always found in cities and other crowded places.

That of the country is derived principally from a vegetable source, together with the saturation of the soil from time to time with rain, and its evaporation and diffusion. The animal element forms the principal part of that of the city; arising from the changes which the air undergoes from the depuration from the bodies of living animals where many are crowded together, and the decomposition of dead animal matter. Slaughter-houses, soap manufactories, the refuse of stables, sinks, cess-pools and other receptacles of a similar kind, are among the common sources of the bad air of cities, and which impart to the mass of the air qualities not elsewhere to be found.

The sensible effects of the two are different. In general there is no odor in that of the country, while in the malaria of cities it is decidedly manifest.

It has been remarked (*History and Cure of Fevers*, by R. Jackson, part i., chap. iii.) that the miasma of crowded places differs from that of a paludal nature, by being less volatile, and confined to a more limited space; and that it is more con-



centrated in its effects, producing an exhausting and depressing action in a more decided manner.

The morbid effects are different.

In all parts of the world, the tendency to diseases in the country is to an intermittent or remittent type, such as fevers, the common head-ache, and neuralgic affections. Those of the city assume more frequently a continued form, even where there is no specific contagion manifest.

The action of malaria from the soil is remarkable also for the production of epizootic diseases. From the time of the Latin poets and historians to the most recent medical reports and essays of the present day, in every country, we hear of extensive diseases that have prevailed at different times among quadrupeds, from paludal effluvia. Such diseases and such mortality are very rare in cities. We have heard of sickness among horses in the vicinity of a city during a pestilence; but a decided epizootic is of rare occurrence and of very limited extent within its bounds; and where an epidemic prevails in such places, the simultaneous sickness among quadrupeds is recorded as a remarkable event.\*

In the country, malaria would seem to require a temporary or transient cold state of the air, or of the body, to produce its effects on the system. So universally remarked is this, that the exposure to the cool night air is considered as sure to produce a malarious fever; and it has been referred to the cooling of the body by terrestrial radiation, when soldiers have been taken sick who slept on the ground without tents or other covering, while those who have had bushes, trees, or tents over them have escaped. It cannot be the same malaria that produces cholera infantum as witnessed in cities, inasmuch as it always attacks the greatest number while the heat is greatest, and no danger is apprehended from its temporary mitigation.†

In the country, disease from malaria mostly attacks adults;

\* See Appendix, D.

† See Appendix, E.

infants born in such places are in general exempt. The reverse is the case in cities; children are the most subject to its malarious influences, and the natives are the first to experience their effects when the season arrives to set them in action. The great mortality from cholera infantum shows that there is but little exemption from its effects among them.

If this disease is caused by the same influences that produce malarious fevers, it would prevail at the time such fevers exist. On the contrary, the greatest number of cases occur in July and August, and when they begin to lessen in number, the paludal fevers increase. We should also expect to find it prevail more during the season when cases of autumnal fever occur in the greatest number. This, however, is not the case, where we have had opportunities of obtaining the most reliable information. Whatever amount of sickness exists in the country surrounding the city of New York, cases of cholera infantum observe a remarkable uniformity as to numbers, evidently under influences different from those producing the febrile affection. In the year 1828, malarious fever prevailed very extensively and with great severity in the country around that city, proving fatal in a great number of instances. Many of the villages were nearly destitute of inhabitants, farms were offered for sale or to lease by their terror-stricken owners, and persons unaffected by the disease were scarcely in sufficient numbers to attend upon the sick. Hundreds fled from all parts, even from the immediate vicinity of the city, and took refuge within its precincts. Various parts of New Jersey, Staten Island, Westchester county, and the regions particularly near the city, were the principal places affected by the disease. It also prevailed with great severity on Long Island, where it was attributed to malaria from decaying vegetable substances exposed to great heat. Several communications appeared in the daily newspapers on the subject, and they speak of noxious vapors of which a single inspiration was injurious.\*

\* See Appendix, F.

During that year, the mortality from cholera infantum in the city of New York was one hundred and sixty-one, or one in thirty-one of the whole number of deaths ; not so great as in the two previous years, when they amounted respectively to two hundred and twenty-two and two hundred and thirty-eight, or one in twenty-two of the deaths. This was also the case in other years ; a reference to which is made in the Appendix.\*

The disease we are considering appears to differ essentially in miasmatic places from that which occurs in cities. The number of cases of cholera infantum "under 15 years," of which the statistics are given in the report above referred to, as occurring in 1852, in the States of Kentucky and Tennessee, is *fifty-two*. The average attendance of fourteen of them was *four days*, and of seven, *nine days*. The period of attendance required by the remainder is not given, while the mortality of the whole number was *four*. It would seem therefore to differ from the disease known by the same name in cities.†

In the report on the diseases of the same district for the year 1853, one hundred and thirty-five is the number given for the entire State of Kentucky. The necessity there stated for using quinine in its treatment indicates also a very essential modification of the disease in the western part of the United States. The report also states that on a comparison with other diseases that prevail there, cholera infantum has a nearer relationship to dysentery and typhoid fever than to bilious fever ; from which there would seem to be an admission that there is some other exciting cause than that which produces paludal fever.

Cholera infantum appears in diminished numbers in proportion to the distance from crowded places, and is most successfully treated when the patient is removed out of the limits of the city even to a short distance ; but if the disease came from one and the same cause, and that cause marsh miasm, no mitigation would occur by moving into the air

\* See Appendix, G.

† See Appendix, H.

which, from its greater proximity to the source of the poison, would be more active in producing its deleterious effects.

From the facts now stated, so far as cholera infantum is dependent on external causes, it is evident that in addition to high range of temperature and inordinate atmospheric humidity combined, it has for its cause the peculiar malaria of crowded places.

OBSERVATION 4th.—*Period of Life*.—Cholera infantum prevails more before the first year than during any other period. Although there are no published statistics that show the mortality at the early months, yet it is well known to all practical men that the disease prevails less during the first six months and more from that time to half of the first year. From the first to the end of the second year it exists with varied intensity in different individuals, and after the second year the number is small.

In the city of Philadelphia, during a period of twenty years, prior to 1827, there were three thousand eight hundred and twelve deaths reported from disease designated under the general title of cholera, among persons of all ages—cholera morbus or cholera infantum. Of this number three thousand three hundred and eight were under the age of two years; all of which were doubtless the *cholera of infants*, as that term is used to designate a specific disease.\*

In the city of New York of fifteen hundred and twenty-five deaths from this cause in 1854, thirteen hundred and sixty-four were under the age of two years, and of three thousand one hundred and sixty deaths which occurred in three years, two thousand seven hundred and forty-seven were under that age.

The time, therefore, at which the disease is at its height is that of the period of second infancy, when important physiological changes occur, manifested by the appearance of the teeth, the development and activity of the salivary glands, together

\* See Appendix, I.



with alterations in all the organs of digestion ; a state of system which, it will be seen, when considering the pathology of the disease, is inseparably connected with its development.

OBSERVATION 5th.—*Inappropriate Food*.—This is an occasional exciting cause, acting with those already mentioned. Where a child is artificially fed, there are often indigestible substances of a farinaceous or starchy nature given, that greatly disorder the digestive organs, from the impossibility of assimilating them ; these organs being unfitted for the reception of vegetable aliments. There is another form of food, which does not appear to have attracted the notice of writers on cholera infantum, but which is of importance when considered in connection with the causes already mentioned. It is the deterioration of the mother's milk from the debilitating effects of the atmospheric influences already considered. The mother suffers as well as the child, and it appears quickly in the secretion of the milk, manifested principally in its lessened quantity, while the process of nursing is one of fatigue and exhaustion. Even if it is difficult to prove any alteration in the chemical qualities of the milk, yet the fact is well established that the milk will undergo changes at times of such a nature as to impart injury to the child. We have proved this by withdrawing the child from the breast, although in general opposed to weaning children that are sick.

#### GENERAL PHENOMENA.

At the present stage of the investigation we shall state the symptoms in a general way, and those only which impart a character to the disease, and from which it derives its distinctive name, and not those which are the result of its varied forms of manifestation or of its complications ; the object being to connect the signs of derangement which distinguish this disease from every other, with the causes which produce them. The statement of the phenomena in detail will be reserved for a

section on the semiology, immediately preceding that devoted to the treatment.

The disease is characterized by inordinate evacuation from the bowels, generally accompanied by vomiting. Whatever be the different modes of its invasion, whether with or without febrile action or the existence of nausea, diarrhœa is usually the first symptom. The simultaneous existence of vomiting and purging at the beginning of the disease indicates its severity; and under such a mode of attack, it will often terminate fatally in a few days. In the greatest number of instances, the diarrhœa alone is its earliest manifestation, at first consisting of the ordinary fœcal matters, changing soon, however, to a serous fluid of different hues. At intervals the discharge consists of the mucous secretion of the intestines, mixed with undigested food. The odor differs from ordinary fœces; sometimes, when it contains the ingesta, it is indescribably offensive. At other times it is in a state of fermentation which imparts an acid odor, not unlike that of the chyle before it has reached that part of the primæ viæ where the biliary duct opens into the intestines, it being diluted only with the follicular secretion. When the disease is fully established, the absence of bile is one of its distinctive marks, while the discharges indicate ulceration. Vomiting, or attempts at vomiting, is another prominent symptom, and is one of the most uncontrollable and obstinate of all the phenomena. The discharges by this act never consist of any thing more than the food or drinks that have been given. All these symptoms are accompanied by inordinate thirst.

Next appear a dry and flabby state of the skin, with intense heat on that covering the abdomen. Rapid emaciation follows, and the body becomes attenuated to a most frightful extent. As the disease advances toward a fatal termination, the natural stools are retained, and the mucus becomes gelatinous, and often pink-colored. The disease usually lasts a month or six weeks.

Lastly, evidences of cerebral disturbances show themselves, with occasional convulsions. These and other compli-

cations, being additions to the essential symptoms of the disease, are not here particularly noted, although constituting a necessary part of the ultimate development.

### MORBID ANATOMY.

In the different parts of the intestinal tube there are found numerous granules having at their external surface a minute pore, from which the mucus secreted by the gland is exuded. They are known as the mucous glands or granules, and also as the muciparous follicles. Although they are very numerous in the upper part of the intestines, yet they exist detached from each other; while from the jejunum downwards they appear in groups. But one function is discharged by them all, that of furnishing mucus to the surface of the intestines, although they are distinguished by different names in different parts of the intestines. They will be considered in this Essay with reference only to the functions they perform, and denominated mucous follicles.

These follicles rarely make their appearance until about the time of teething, when a general development of all the parts connected with the assimilating process takes place. When the teeth appear, the mucous follicles are brought into action, and are apparently connected with the necessity of a change of food for the child.

In cholera infantum the most remarkable anatomical change is found in the excessive development, the functional activity, inflammation, and occasional ulceration, of these follicles.

Instead of pursuing an elaborate detail of the appearances presented on postmortem examination in every organ and cavity of the body, many of which are secondary and the effects of complications, we will refer to two lithographic representations of the actual anatomical changes in parts which are primarily affected, and which continue to be the principal parts diseased, whatever modifications the disease may assume; the symptoms of the local derangement which

characterize the affection always being aggravated the nearer the approach to a fatal termination. As the fairest method also of ascertaining the morbid changes, we propose also, to exhibit an analysis of all the postmortem examinations that have been recorded, so far as we have been enabled to find them in the different medical periodicals.

*Anatomical Illustrations.*—No 1. The colon of a child, aged 6 months, that died of cholera infantum. The mucous follicles were all enlarged, but scarcely any of them were ulcerated—the whole mucous surface appeared to be covered with white elevated spots.

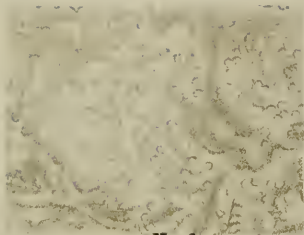
No 2. The colon of a child, aged 1 year and 8 months, that died of cholera infantum. A large number of the glands were not only enlarged, but ulcerated; indicated in the accompanying representation by the central dark spot.

*Anatomical Analysis.*—On examining most of the medical periodicals which have been published within the past fifty years, we have found recorded the postmortem examination of thirty cases of cholera infantum.\* Of this number there were twenty-eight reported as presenting the liver diseased, either by being congested, enlarged, or altered either in color or texture. Its color was in many instances lighter than usual, and in others “variegated.” It was in most instances firmer than is the case in health. Dr. Horner observes that the liver is generally enlarged and of a more firm and solid texture than is the case in the natural, healthy condition. Only in two cases, the liver was reported healthy, or, as it is termed in one instance, “appeared healthy.”

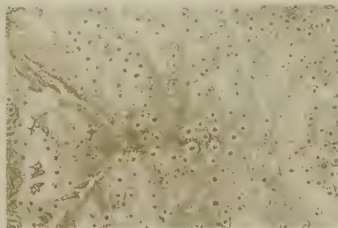
The next fact to be noticed is, that in the whole number, the mucous membrane of the intestines was found diseased, inflamed with mucous exudation, congested, or ulcerated. These statements were made before Dr. Horner published the

\* By Drs. Jackson, N. E. Jour. Med., v. 1; Horner, Am. J. Med. Sci. v. 20; Stuart, Coxe's Med. Mis. v. 3; Baxter, N. Y. Med. and Phys. Jour. vi. N. S.; Lindsley, Am. Jour. Med. Sci. v. 24; Hallowell, Am. Jour. Med. Sci. v. 40.





**No. 1.**



**No. 2.**



results of his examinations. He observed the same condition of the mucous membrane ; but on removing the mucus and blood by a little maceration, he was enabled to note the true organic changes that had occurred, by discovering the delicate prominences of thousands of inordinately developed mucous follicles—a large number of them in a state of ulceration. In the examination of two cases by Dr. Baxter and twelve by Dr. Hallowell, the same condition was found, and which is also represented in the lithographs accompanying this Essay.

The disease, therefore, exists mainly in the mucous follicles and in the liver. The effusions and congestions in the brain and other organs are clearly complications of the original disease; and although exhibiting serious affections of those parts, yet these organs do not, so far as we have been able to ascertain, present any decided alteration in the structure itself, as is found in the liver and mucous surface of the intestines.

#### P A T H O L O G Y .

The pathology of a disease should be studied closely in connection with the causes which produce the morbid changes exhibited on postmortem examinations. It is evident that an anatomical investigation can give us only the morbid results of diseased action, and is therefore to be regarded as but one extremity of the continuation of a morbid condition of parts ; the other exists inscrutable to us, except in the symptoms which characterize it, and in the immediate results of the causes in operation to effect the changes which produce these symptoms. While the anatomical alterations show us the terminations, we must seek for something else anterior to them for instruction as to the actual condition of the living parts at the commencement, and thus endeavor to ascertain what it is that leads to these changes. Often in the examination of the philosophy of disease, we are obliged to be contented with learning from the symptoms during life, and the anatomical condition after death, on what to found its pathol-

ogy. If it be possible to add to them the known causes, and if these are not only clearly established, but are found to be peculiar in their immediate effects, we obtain a starting point of great importance, which if carefully studied and the course indicated by them be as carefully pursued, will add much to our ability to interpret the revelations of the scalpel.

As cholera infantum can be referred to well-ascertained causes, and as these agents are in action to maintain the disease, when established, by their constant and positive influences, there can scarcely be found a disease that can so well elucidate the importance of endeavoring to establish the connection between the early morbid action and the ultimate morbid results.

It is for this reason that the causes already exhibited will be taken up in their order, their philosophy examined, and the morbid conditions produced by them studied in connection with the alterations revealed after death.

1st. *Heat.*—The effects of atmospheric heat on the system are direct and indirect. By the direct effects are to be understood those sudden disorders which are the results of an accelerated action of the circulatory organs, or the more rapid exhaustion of the nervous power. This sudden invasion of disease during the intense heat of summer in temperate regions, and in all hot countries, among those not accustomed to them, is well known. The consideration of this class not being a proper subject for this paper, it will of necessity be passed over; while the indirect effects, or such as are less prompt in their manifestation, as in the disease now before us, will form the proper subject for investigation.

There is one organ which exhibits before all others the effects of heat, and that to a remarkable extent. From the earliest period the liver has been regarded as the one that suffers most from this cause; and a host of writers on the influence of tropical climates and their diseases, refer to atmospheric heat as the principal source of hepatic affections.

Such affections prevail to so great an extent in hot climates that those who have practiced in temperate regions

alone, will find it difficult to believe in their extensive prevalence, among natives as well as among strangers. Although there may be auxiliary causes, yet it is by the most accurate observers attributed to atmospheric heat as the principal cause. Thomas, Johnson, Moseley, Saunders, Larrey, Fitzpatrick and others, who have resided in hot countries, refer to heat as the agent to which the alterations in the action and organization of the liver are to be attributed. There is no other organ on which caloric appears to be concentrated in its effects, and none whereon the consequences are so marked.\*

In some instances an active condition of this viscus is produced, marked at times by an inordinate secretion of bile; in many of them a want of action ensues, following this excessive action as a state of collapse follows that of inordinate excitement.

Among the effects of heat on the liver is that which is denominated chronic inflammation. This term appears to have been applied to various affections of this organ, which differ from the acute or active inflammation. A score of morbid conditions are referred to chronic inflammation. These morbid states, it is plain, may differ very essentially from chronic inflammation, and yet collectively they have been so denominated. Among these derangements is found a simply sluggish or congested state; when it becomes slowly indurated, with or without enlargement, and when it no longer performs its office of secretion of bile. This is a very common condition in the East and West Indies; a torpid condition of the liver and a paucity of its biliary secretion, are very frequent disorders in those places, attended with constipation and indigestion.

These are the consequences of disease protracted for years; but in affections of this organ arising during a shorter period, alterations less marked are to be looked for; and such are revealed in cholera infantum.

\* See Appendix, J.

As heat exhibits its action on the hepatic system, so cold shows itself upon the respiratory organs, less extensively ; but it is much more decided in its manifestations. Affections of the liver are more or less obscure ; as this organ is less under our cognizance, both in its condition of health and of disease, little evidences of its diseased condition exist, and obscurity and uncertainty often attend its derangements, both in the young and the adult.

Summer and winter show their effects very promptly on the tender and susceptible system of the infant ; the winter not among so many individuals, partly perhaps on account of the ability of most people to shield themselves and their offspring from the extreme cold, while from the intense heat of summer there is no escape.

Infants yield quickly to the influences of cold, and suffer greatly from affections of the respiratory organs during the winter ; while there is no marked disease among them during the excessive heat of summer, unless it be derangements of the chylipoetic viscera. The "summer-complaint" is the popular name for one form of these derangements, from its extreme prevalence during the existence of a high range of temperature. In the absence of any facts to show that heat will produce a decided effect, among a large number of individuals, on any other part of the system than the hepatic, it would seem to be but reasonable to suppose that the gland which is so generally affected by it would not escape in the infant, but would be the part that would be primarily diseased under the circumstances which produce so violent a disorder as cholera infantum, or "summer-complaint."

The first effect of heat upon the system is through the lungs, and by interfering with the proper discharge of the respiratory function ; this act being the introduction of oxygen during inspiration, and the ejection of carbonic acid during expiration. It has been proved by experiments on small animals, that a much less amount of atmospheric air is decomposed during hot than during cold weather. In an expe-



riment by Crawford, it was found that a guinea pig under a temperature of  $55^{\circ}$  consumed twice the quantity of oxygen than when confined to a temperature of  $104^{\circ}$ .

The connection of the process of respiration with affections of the liver, will be considered when the effects of the next two causes are examined.

*2d. Excessive atmospheric humidity.*—This is one of the principal causes of the extreme languor in hot and crowded places. One of the modes by which extreme moisture, with heat, acts unfavorably upon the body, is by preventing the ordinary amount of exhalation from the lungs. This is most decidedly seen when the excess of moisture arises from great crowding, and the usual domestic occupations in houses where several families reside. The houses of the poor are loaded with vapor from these causes; the temperature at which moisture is deposited scarcely differing from that of the air. We have tried the experiment with a wet bulb thermometer where the temperature was at  $90^{\circ}$ , and could not make the dew-point lower than  $88^{\circ}$ . It has been probably often at the point of saturation, when they will both range at the same degree.

The air always contains moisture, and in proportion to the amount is the quantity of moisture exhaled from the lungs. Thus, air containing moisture that is deposited at  $38^{\circ}$ , the average in this climate, will allow of a much greater evaporation from the lungs than when the temperature of the “dew-point” is at  $70^{\circ}$ .

It is shown by the experiments of Dalton that the quantity of vapor contained in a cubic inch of air when the dew-point is at  $38^{\circ}$ , is .00166852 grain; when at  $94^{\circ}$  the amount is .00938243 grain. The last mentioned is the dew-point of the vapor as it is expelled from the lungs, whatever may be the temperature of the surrounding air; and this is the amount of vapor contained in a cubic inch of air as it passes from the lungs of an adult. If the air before inspiration be overloaded with vapor, it is obvious that it must prevent to a certain extent the depuration from the lungs. We have found,

however, that unless the amount of vapor in the air very nearly approaches to that passed from the lungs, no very marked effects are produced, but a sense of oppression and suffocation arises when it approaches that point.

The weight of a cubic inch of vapor at  $88^{\circ}$  is .00789288 gr. which is .00622436 more than the mean of the climate, and .00158152 less than the amount contained in the pulmonary vapor. If these be multiplied by 1,152,000, the number of cubic inches inhaled in a day by an adult, according to Thompson, Minzies, and others, the result will be respectively 7170 and 1811 grains; the difference between the two—5359 grains—will give the lessened amount of transpiration of pulmonary vapor. When at  $70^{\circ}$ , the highest in this climate, the weight of a cubic inch of vapor is .00461639; if this is subtracted from .00938243, which is the quantity in a cubic inch of respired air, it will leave .00476604, which multiplied by 1,152,000 will give 5490½ grains of water evaporated from the lungs when the air is inhaled at a dew-point of  $70^{\circ}$ . These statements will show how much an excessively high dew-point must interfere with a proper depuration from the lungs.

Another source of embarrassment to the full healthy depuration from the lungs is the increased elastic force of vapor at a high temperature. According to Dalton, this power at  $38^{\circ}$ , is .264, and at  $88^{\circ}$  1.286, in inches of mercury.

There are, therefore, two obstacles to a free pulmonary exhalation in an inordinately moist state of the air.

The lessening also of the transpiration from the skin, from the same causes, has an important influence upon the healthy action of the body, as is known by daily experience; but the arrest of cutaneous depuration by means of excessive moisture of the surrounding air differs in its effects from that produced by cold.

The principal results of an arrest of the ordinary pulmonary depuration is to cause some movement of compensation in another part; the consideration of which will be deferred until the next subject has been investigated.

*3d. Malaria.*—There are two alterations in the air when-



ever there exists any deterioration; one is the chemical change, and the other, a simple mixture of foreign and deleterious ingredients. In all crowded places the chemical change must be principally that of an excess of carbonic acid from the constant respiration. This arises from the process of respiration being that by which oxygen is introduced into the system through the blood, and thereby causing in the ultimate tissues the combustion of carbon, which escapes from the lungs as carbonic acid.

According to the experiments of MM. Dulong and Despretz, the quantity of carbonic acid thus produced is the same as would result from the combustion of an amount of carbon equal to that of which the body is deprived by the act of expiration; the carbonic acid passing into the surrounding air, and taking the place of the oxygen which is removed by inspiration. By respiration alone, an adult will transform into carbonic acid in the space of an hour, all the oxygen contained in twenty-five gallons of atmospheric air; which in a house, and especially in a sleeping apartment, is a matter of great importance.

From this process, also, arises the increased heat of a crowded room; the union of the carbon and oxygen producing an additional heat, which is added to the atmospheric temperature already existing,—the body of every animal being a constant generator of heat. The same changes occur outside of our dwellings, but are less injurious, from being more easily diffused and dissipated.

Another change in the surrounding air is produced by transpiration both from the skin and lungs. It is a mixture solely, and is independent of any chemical change. This addition eludes altogether chemical tests, and exists, it would seem, only as suspended in the atmosphere, and is conveyed by it as a foreign body, or rather by the vapor that is always present in the air. The transparent fluid exhaled from the lungs is in every respect the same; the taste is saltish, the color peculiar, and it becomes insupportably offensive when

kept in a warm place ; showing that it consists of animal matter in a state of decomposition.

The perspiration is sometimes differently scented ; it has had the odor of musk, violets, sulphur ; and it has also been extremely foetid and occasionally acid. It has also been variously colored,—red, saffron, black, or blue.

These facts would appear to show that the substances transpired possess properties derived from the body, and ejected as not proper to be retained. This transpiring process is indeed one of depuration, and to the extent of twenty-eight ounces in twenty-four hours. It must be, therefore, injurious to be receiving into the body by inspiration that which its necessities have previously required to be removed. Who but infants would be the greatest sufferers ? a class among which the effects of external influences, of whatever kind, are so promptly experienced, and to which they so promptly yield.

All the conditions of the atmosphere which have been considered, directly interfere with the ultimate object of respiration, and when they are all present in a marked degree, the effects will sometimes appear in the embarrassment of the act itself.

When any organ is disturbed in the exercise of its appropriate functions, and a morbid action arises, the system struggles, as it were, for relief ; and under this derangement, some other will be found either to be involved in the derangement, or to have assumed its functions, and thereby to have relieved the morbid condition of that one which was primarily affected.

This is of so ordinary occurrence that when a morbid functional change arises, we naturally look for a vicarious movement, which either affords relief, or by too great a demand on the energies of the body for that purpose, passes into a diseased action in a part of the system distant from that originally affected. This movement of compensation is familiarly illustrated in the reciprocal affections of the skin and kidneys, skin and lungs, etc., in a low temperature.

That between the lungs and the liver is no less remarkable, and equally important in its results.

When the air becomes unfit for the necessary renovation of the blood through the medium of the lungs, or when the usual amount of depuration from them is prevented, their functions are but imperfectly performed, and the requirements of the system inadequately supplied. Under this condition, especially when the interference is slight, but is at the same time protracted, no sudden evidence of derangement presents itself, but a decided action will be established in a part that evidently bears a reciprocal relation to the lungs. This part appears to be the liver, for the following reasons:

According to the experiments of Tiedemann and Gmelin, it has been found that the quantity of venous blood sent to the liver increases as the pulmonary system is less perfect. In the mammalia the vena portæ conveys blood from the intestines alone; in reptiles it is also brought from the posterior extremities, tail, kidneys, and other parts. In connection with this, is the fact that the temporary suspension of the functions of the lungs, and the consequent arrest of the flow of blood through them, in hybernating animals during their period of sleep, is not attended by a suspension of the functions of the liver, bile is secreted as usual; corresponding with the human fœtus, where the total inactivity of the lungs appears to be compensated by some action of the liver.

The vicarious action of the liver, is also manifest in the pathological condition of that organ from the effects on the respiratory process. Some of them occur in malarial districts, and are well known to residents of those places. Hepatic diseases affect hogs and sheep that are exposed to paludal effluvia, while "gall sickness" is a popular designation for similar disorders among men. One of these results, which exhibit in a strong light the connection of the morbid derangement of the lungs and liver from malaria, is the complication of pneumonia with hepatic disease, known as bilious pneumonia.

Another illustration of the vicarious action of the liver,

when the functions of the lungs are impaired, appears in the fact that fatty livers are frequent in pulmonary phthisis, of which M. Louis and Dr. Horner give several examples. The former mentions forty-nine cases, of which number forty-seven were dependent on that affection. Fat, it is well known, abounds in carbon.

That morbid hepatic affections will arise from breathing in a confined atmosphere, where the lungs are forced to receive air deprived of a portion of its oxygen, appears from the results that have followed experiments on animals purposely confined where the air could not be freely renewed. Dr. Baron placed several young rabbits where they could not obtain fresh air, feeding them on cabbage and grass. One of them died in a month, and presented a morbid condition of the liver, consisting principally of vesicles over its external surface. In nine days another died, with tubercles in the same viscus. In four days another died, with the whole of the liver diseased; and in two days another died, exhibiting the liver in the same condition. The three that remained were removed to an open situation, and recovered.

Physiology, and the comparative anatomy of this organ, support the opinion that it does perform a function supplementary to that of the lungs, and that, with respect to the venous blood that enters it by the portal vein, it is an organ for depuration, being the only one in the body in connection with the lungs, if we may except the skin, that acts in removing the carbonic acid from the system. The skin, however, is very limited in its excretory function in this particular.

That which appears to be the most prominent fact when considering the external causes of cholera infantum is, that they all are connected with some interference with the proper discharge of the functions peculiar to the lungs, and consequently with an imperfect removal of carbonic acid from the system.

The importance of this depurative process is evident from the physiological history of all animals; they all require oxygen, and the effect of its use is uniformly the presence of



carbonic acid in the air, with which they are surrounded, when the circumstances are such as to prevent the results of respiration from being dissipated.

It cannot be supposed that whenever so general a law of animal nature is interfered with, the system would retain its healthy vigor, and discharge with suitable energy its varied functions. It would seem as if the retention of carbonic acid is the retention of an effete substance possessing peculiarly injurious qualities, and which, by the action of some of the organs, must be removed. So virulent, indeed, is the poison, that if all the oxygen is removed, so as to preclude the possibility of its action on the body, speedy death ensues; if a less quantity than is required be supplied, uneasiness, debility, and fainting follow. In an atmosphere containing more, but still less than would satisfy the requirements of the body, a protracted derangement of one or more of the organs is the result.

Now, the lungs perform the function of relieving the system from this pernicious ingredient; and all the causes which have been considered do, each in its own way, interfere with this process. Thus, it has been proved by direct experiment on small animals, that a lessened consumption of oxygen occurred as the temperature increased, and that a difference of  $49^{\circ}$  made a difference of one half of the amount consumed. Excessive humidity added to this high temperature, also interferes with the proper action of the lungs, by preventing a full exhalation. Malaria, especially in crowded places, also interferes with the function of respiration, by supplying air deficient in oxygen, and charged also with foreign ingredients. All these causes of the disease unite in interfering with the normal results of respiration, either by rendering the air deficient in what may be denominated the vital ingredient, or by some physical modification which prevents a sufficient quantity from being inhaled.

There being no proof that the active causes of cholera infantum directly affect the mucous membrane of the intestines, but abundant evidence that they do produce a morbid

change in the liver, this organ is probably the first of the abdominal viscera that is affected in the disease, by the establishment of a vicarious action; the lungs not freely relieving the system, and the liver being a supplementary organ performing a part of their functions.

The transition from an over-excited state of this organ to one of collapse or congestion, and to other morbid conditions, is a subject familiar to every medical practitioner, and requires no illustration.

The morbid state of the mucous surface of the intestines follows next, being the result of the morbid condition of the liver, as will appear when the influences of the fourth cause are considered.

*4th. Period of Life.*—This may be regarded as the predisposing cause, for the disease never appears but during the period of teething. When children that have passed that epoch are exposed to the causes already considered, the result is dysentery. This the writer has repeatedly seen in the same house, during a hot season, where cholera infantum has prevailed. When the affection of the bowels that was excited in the older children continued for a few days, it always assumed the form of dysentery, but never that of the peculiar disease of infancy.

When the morbid condition of the intestines was stated, it was shown that the source of the flow was the mucous follicles that studded the greater part of the intestinal surface, and that these follicles presented an appearance of inordinate development, inflammation, and ulceration. Their development is peculiar to the period of life at which cholera infantum appears, is the result of the natural movement of the system, and is simultaneous with the eruption of the teeth. The inflammation and ulceration of the follicles are superadded morbid action, constituting the disease under consideration.

In the infant and child, the active process of development is an important predisposing cause of disease. In them everything predominates that is connected with organic growth. The desire for food is frequent, the digestion rapid,

the blood and fluids are in excess ; capillary action, secretion, and interstitial increase proceed with great vigor ; while the nervous sensibilities are in high activity. Growth of parts seems in truth to differ from inflammation only in degree, which may very speedily be induced upon any disturbance of the developing process.

It has been remarked that infants grow more during the first year, the increase becoming less rapid as the child approaches the fourth or fifth year ; and it is well known that during the first-mentioned period, violent disease and sudden mortality more frequently occur than at any other time of life. Here, then, is a direct relation subsisting between the rapid increase of the body and its tendency to severe and fatal disease ; the naturally exalted action of the capillaries in developing a part being easily made to pass the boundaries of the healthy process of growth, and become the active agents of inflammation ; the effects of which are of marked peculiarity,—prompt serous effusions from some membranes, and in others the exudation of lymph, as in the trachea in inflammations of that tube.

The diseases of the brain furnish an evidence of the transition from health to disease during the process of growth ; it is well known that at the time of birth the cerebral organ, although large, is exceedingly imperfect in its organization, consisting of a mass almost like jelly. It is not complete in its parts until a year or more has elapsed, during which period the vital energy of the part is in great activity, carrying on the process of development. Congestions, effusions, and convulsions, are more common at this time than at any other.

In other instances there is an excess of action in one set of organs, which gives a preponderance of one system over others, as in the lymphatic ; producing congestions and obstructions in the different glands of the body.

Another illustration of the effect of the development of parts in the production of disease, is that afforded by the mucous follicles of the intestines. When, in the order of the natural development of the infant's frame, these follicles for

the first time show themselves in connection with other parts concerned in nutrition, they are in a high state of activity, pouring forth an abundance of their natural secretion. Thus far the action is a natural one, and one of health. Should it become excessive, a serous diarrhœa takes its place, demanding the interference of the physician for its removal. This same condition of the development of the follicles, when complicated with other derangements of the system, and kept in a state of morbid activity by the continual operation of certain exciting causes, terminates in producing one of the most fatal diseases of our climate, the cholera of infants.

Dissections of infants that have died of various diseases, have exhibited the development of the mucous follicles, commencing at the time of the appearance of the teeth, while before that time they are rarely to be seen. Numerous post-mortem examinations\* show that the follicles experience an increase of vital energy which augments their secretion, and renders their size larger and their number greater, but which still does not produce any redness, tumefaction, or ulceration. Their activity in secretion during the time of dentition is the true cause of the ordinary diarrhœa in teething infants, usually ascribed to sympathy with the gums, and which to a moderate degree is not to be regarded as disease, but is the result of the physiological action of the period of life.

The follicles, in the natural course of development, having just passed into a state of activity, are thereby prepared to have an additional or excessive development, on the application of a sufficient cause; and then the transition is both rapid and easy from a healthy to a diseased state.

The normal follicular action passing into an abnormal state, under the influence of the three atmospheric causes of the disease, is effected through the agency of the liver; which, we have seen, is the part on which all these causes exercise their power. They produce disease and alterations in its density or texture, and thereby the passage of blood that

\* Billard, *Malad. des Enf.*, p. 306.



is returned through it from the intestinal surface is obstructed. Congestion of the mucous membrane and its follicles takes place, and nature seeks relief by an inordinate secretion from them, already in an exalted state of action. When morbid action is once established, congestion, inflammation, or ulceration is the course naturally to be expected.

It appears, therefore, that cholera infantum is a disease connected with the development of the body, and is the most remarkable instance of the relation subsisting between the growth of parts and the diseases of childhood and infancy. The effect of growth shows itself in the violence of inflammatory diseases, as connected with the exalted state of interstitial nutrition, so characteristically rapid at an early period of life. At one time, it is exhibited, as we have seen, in a peculiar exudation from the blood, abounding in fibrin, as in croup; again, in the morbid action connected with the changes in the cerebral organ; at another time, in the succession of diseased action of the different parts of the glandular system; and in the disease now under investigation, in the morbid development of the mucous follicles of the intestines during the period of second infancy.

*5th. Inappropriate food.*—There is little to be said upon the action of food that is digested with difficulty. The portion not disposed of by the action of digestion becomes, it is well known, an irritating body, which, of course, must irritate all the parts through which it passes. That kind of food which is the most quickly absorbed is least likely to add to the causes already in operation to develop the disease, which must be promoted by intestinal indigestion.

#### SEMEIOLOGY.

The division of diseases into different stages, is both natural and useful. Like all other natural phenomena, disease has its peculiar signs in its incipency, maturity and decline; exhibiting phases which indicate the kind of interference which it is necessary to adopt in its management. Without

availing ourselves of these as a guide, the practical employment of remedies would be equally unscientific and unsafe. The boundaries, however, of the different stages do not always appear so distinct as to enable us to detect clearly the progress of the disease from one to the other, and the complications add their influence in rendering the actual knowledge of the condition of the affected parts obscure, and thereby often tend to embarrass the judgment.

Cholera infantum, in its progress, appears in three different conditions or stages. The first is marked by an increased activity of the bowels, the second by inflammation and ulceration, and the third by complications.

The evacuation in the first stage consists, at the beginning, of the usual *fæcal* matters, more largely mixed with watery fluid than in health. Indeed when the disease is gradual in its invasion, no difference will be observed between it at the early stage and the diarrhœa of teething infants, which always precedes cholera infantum, and is in truth its commencement. The discharges consist largely of serum, mixed with mucus or minute shreds, or colored with bile; but in all its forms it is characterized by copious watery evacuations, which, at the period of teething, are often so abundant and debilitating, that the child is in a few days exceedingly emaciated and exhausted. This is probably the form that is known as the “watery gripes” in England, when it has not passed into the decided morbid condition which will be more particularly noticed as the second stage.

To a moderate extent, diarrhœa at the time of teething is salutary; should it, however, increase in severity, and exhibit a diminution of bile, we may regard this increased action of the mucous follicles as evidence of the congestion of the mucous surface of the intestines, from some degree of congestion of the liver; the morbid action of both these parts being the pathological condition of cholera infantum.

Although for the most part serous, the consistency of the passages will often differ in the course of the day,—sometimes thick and pasty, or frothy, at other times bearing a resem-

blance to the yolk of a hard-boiled egg beaten up with water.

This diarrhœa affects the system both by the debilitating effects of the increased peristaltic action and by the prostration occasioned by the great secretion from the mucous surface.

In this diarrhœa the color of the discharges will be different, not only in different individuals, but also various in the same patient at different times of the day—yellowish, light green, or of the peculiar color of serum, and equally as transparent. This last condition we have frequently seen, and so destitute of any additional substances, as to have been mistaken by the nurse for the urinary discharge, and the fact mentioned of the excessive amount of urine passed by the child, when in truth there had been none.

It is rare that vomiting occurs very early in the disease; yet, when it arises simultaneously with the first appearance of excessive purging, the disease is proportionately severe, and exhaustion and death will often ensue, without any complication, in a very short time. We have witnessed death under these circumstances in twelve hours. Such instances, however, are rare, and it is unusual for a fatal termination to occur during the first stage.

The vomiting, or efforts at vomiting, is a marked feature of the disease. All observers must have noticed its obstinacy and the peculiar kind of action attendant on the attempts at vomiting. This effort is sometimes connected with a powerful action of the abdominal muscles; and they will be found at times, on placing the hand over the abdomen, to be in a convulsive or rolling motion, generally simultaneous with the action of the stomach. At other times when the disease is severe, this movement of the muscles will take place without any attempts at ejecting any thing until the paroxysm is about ending, when the efforts to vomit will occur.

The tongue is moist, and covered with fur of a light brown hue at its base. The thirst is invariably very great.

The febrile condition does not arise from an essential or

primary fever, but is clearly of the class of irritative fevers; it rarely appears at the beginning, but increases with the progress of the disease, occurring in irregular paroxysms of different degrees of intensity. The heat of the surface of the body augments in the course of the disease, especially in the abdominal region.

The pulse is small, quick, and frequent, sometimes sharp and wiry.

The second stage is the period of inflammation and ulceration. The general heat of the body decreases, while that of the abdominal surface increases to a high degree of intensity.

The tongue is parched and heavily laden with petechiæ at the sides and at the commissure of the lips. The child seizes with frantic eagerness any drink that may be offered.

The serous diarrhœa increases, with great variety in the appearance of the evacuations, and with the addition of mucus. While before, the predominating color was yellow, it is now frequently of various hues of green. At times the serum appears to be replaced by masses of mucus, of a greenish tinge to a deep hue of that color. Although a yellow or green color may indicate the presence of bile, yet the alvine evacuations may, in disease, assume this appearance without the presence of bile. The jelly-like mucus derives its color from the alterations in the secretion produced by inflammation, as is occasionally found in mucous discharges in disease in other parts of the body. In bilious evacuations, there is a decidedly faecal odor; in the colored mucus, none. The color is also changed to a brown or white, and frequently pink. During their evacuation the usual faecal matter is retained.

These discharges are at times peculiarly offensive, at other times they exhibit no other odor than that which is derived from acid. The offensive odor is not that of ordinary fæces, but of the nature which attends the decompositions of animal tissues in ulceration and sloughing.

The evacuations present different appearances, according to the part of the intestines the most affected; thus when the upper part is that principally diseased, they are frothy and



acid, and when the food is passed, it appears almost unaltered by the process of digestion. When the lowest portion of the intestines is the part, the disease bears a resemblance to dysentery, and the evacuations are bloody and slimy, and attended with tenesmus and pain.

In inflammatory affections of the bowels in children, there is always some sympathetic affection of the brain; and serious disease of this organ will follow an inflammation in the digestive system; a fact well known to the ancients, but more particularly pointed out by modern observers. These pathological sympathies are in general proportionate to the violence of the primary disease, and are indeed so uniform that the meninges of the brain participate in an equal degree with the affections of the bowels, having at one time an acute and at another a chronic action. The brain, in confirmed cholera infantum, never escapes.

When the disease has proceeded thus far, the general aspect of the child is that of distress from pain in the head as well as in the abdomen, indicated by the lineaments of the face. Pain is indicated as existing in the abdomen by a pinched expression of the face, by a fold in the commissure of the lips outside of the orbicularis muscle, and by a lineament extending from this part to the inside of the *alæ nasi*, and sometimes surrounding the orbicularis muscle. Pain in the head is known by a frequent corrugation of the skin below the eye-brows. These most usually occur upon the awaking of the child, and will continue for a minute, or shorter period, before it evinces pain by crying. Added to these, the languor, paleness, sunken eyes, with their dark areola and general shrunken condition of the body, complete a picture of distress which it is in vain to attempt to describe.

The third stage is that of complication and death.

The skin becomes dry and ash-colored. It hangs loose, in folds, about the body, while over the forehead it is tight and smooth. The cheeks become shriveled, and the general aspect of the cheeks and lips imparts an appearance of old age, while the muscles in every part of the body are flabby, and

frightfully attenuated. The eyes are strained, and the adnata are injected; drowsiness, stupor, and partial paralysis succeed, to be followed by death after a protracted term of suffering.

Such is the usual course of the development of the disease in its progress to a fatal termination. When it does not reach the stage of complication, it is often exceedingly protracted; and when the usual secretions are to a certain extent restored, it assumes more of a mixed character, resembling a chronic diarrhœa, and is as obstinate and as difficult to manage as any disease of childhood; terminating fatally from mere exhaustion.

The discharges frequently change their character—becoming serous, mucous, flaky, bilious, and purulent, by turns. This chronic diarrhœa affects the system both by the debilitating effects of the irritation of a large diseased surface, and by the uninterrupted secretion from the mucous membrane; to which may be added the almost total loss of the power of digestion. Whatever is the character of the alvine evacuations, a want of tone in the affected parts appears to be their pathological condition, with occasional ulceration of them.

#### TREATMENT.

In the treatment, it must be kept in mind that the use of therapeutic means is of little avail while the active agents in the production of the disease are in continued action upon the system. Often have we experienced how disheartening it is to be required to administer medicine for the cure of this disease, when the circumstances of the patient are such as to preclude the possibility of applying to any extent the measures demanded by the laws of our physical nature. Even the temporary relief sought during the day is productive of little benefit by a return at night to the close and stifling air of the over-crowded dwelling.

To exhibit by facts in as strong a light as is in our power,



the important influence exerted by a pure atmosphere in overcoming the morbid action in this disease, we will give the results of several cases; those only of a large number, occurring both in public and private practice, of which we have any memoranda. The circumstances under which they happened were so marked, as to admit of their being divided into three classes.

Of ninety-four, forty-four occurred where the concentrated effluvia of about five times more people than ought to have occupied the space of their dwellings, existed, in addition to the refuse produced by them. The odor of the air was at all times distinctly offensive to the senses amidst the stifling heat of the weather. Of these forty-four, twenty died. The next class occurred among persons possessing the ordinary comforts of such as usually apply at the dispensaries, and were about half as much crowded as those already mentioned; they numbered thirty-five; of whom ten died. The last consisted of private patients, and numbered fifteen; of these, two died.

Could we add to these numbers, it would, without doubt, add an abundant testimony in corroboration of the prevailing opinion of the necessity of pure air as a curative agent.

Both as a preventive, and as a remedy when the disease exists, it will be necessary to adopt suitable means to modify the excessive heat and to purify the vitiated air. It is indeed difficult, if not impossible, among such as are exposed to the sufferings and have to endure the privations of poverty, to accomplish any thing of this nature. An attempt, however, may be made by exposing the child daily to the reviving influences of the fresh air, by a walk in the suburbs, or if the situation permit, by an excursion on the water. The causes of the disease are clearly obvious; and these measures it is the duty of all physicians to urge, during the intense heat of summer, that nothing may be omitted in the way of preventing so formidable and fatal a scourge.

It is surprising how often is witnessed among the more intelligent, who are removed from the effects of poverty, an

entire disregard of the simplest rules of hygiene. Frequently we have seen young children suffering from the effects of heat and impure air, languid and sweating, from being crowded in one bed or in one room while the external air is carefully excluded. Placing children to sleep in a low bedstead that has been kept throughout the day beneath another, and only brought out at night, is fraught with the direst of evils, never thought of by those having the immediate care of the children.

There is no difficulty among those whose condition in life enables them to use the simple prophylactic means necessary, to anticipate this and other affections of children that arise from heat and impure air. The doors of all the bedrooms should be left open, while the upper sash of the window should be let down; no danger can arise from the external air admitted in this way, if the bed is removed from the direct current. During the day, in summer, the freest circulation ought to be encouraged by keeping opposite windows open.

Children should never sleep on a feather bed: a hard mattress that will not accumulate the heat is the only kind of bed they should use; while the body ought to be lightly covered.

The prostrating effects of heat in summer are particularly distressing to young children, in whom the activity of the nutritive process is great; and in proportion to this activity of the capillary system, is the demand for fluid; while the increased cutaneous excretion increases greatly this demand for fluid. Nothing will supply this necessity so well and be so refreshing, as a draught of cold water. All persons have experienced this desire; and the uneasiness and fretfulness of young children, who are unable to express their wants in any other way, arise very often from intense thirst, which nothing will quench but cold water. To allay this irritability, is itself of importance, and they may often be calmed at night by a drink of water. This we have always placed among the general preventive measures.

Diet is a very important subject, both in the prevention and management of the disease. One of the greatest evils in

its treatment is the use of vegetable food, either of a farinaceous or starchy nature. The last mentioned, so often given in the form of arrow-root on account of its soft mucilaginous consistency, is especially objectionable. All vegetable substances are unsuited to young infants ; but those of an amylaceous nature being altogether insoluble, are with difficulty absorbed, and when the mucous membrane is diseased, scarcely ever are, but pass as foreign substances quite through the bowels, and may be detected in the discharges by iodine, the usual test for starch. Farinaceous articles are very likely to become acid, and excessively so in this disease. We regard all such articles for food in early infancy as highly pernicious, whether the child be sick or well.

The food that nature supplies is the best, and, if there is no deterioration either in quantity or quality, should be the only food given. When, for any reason, it is necessary to make a substitute for it, milk properly prepared for the child should still be given.\*

In cholera infantum, we have been in the habit of combining a solution of gelatine with the milk, as the most appropriate food for the child ; and, where the stomach is excessively irritable, to give nothing for a while but the jelly, prepared thick or thin, as the child will take it the most freely. The use of this substance has so frequently been followed by decided benefit, that we regard it as a valuable remedy. If gelatine comes under the class of respiratory food only, then it must be regarded as a therapeutic agent. It is so perfectly soluble that it is absorbed as easily as water, and no doubt has passed into the circulation before it could reach the diseased part ; in which respect it contrasts very remarkably with arrow-root, so frequently given in this disease.

As regards the indications of a want of proper nourishing or stimulating power in the nurse's milk, we have been much in the habit of being guided by the instincts of the child, which will cause it at times eagerly to seize some animal substance and suck it with avidity. Following this suggestion,

\* See Appendix, K.

we have directed cow's milk to be given, either diluted, pure, or combined with gelatine, changed occasionally for chicken water, and when the child is especially eager for animal food and has suffered much from debility, beef tea or a piece of fat pork, according to the instinct of the child. These last-mentioned articles, and even salted meat, are especially beneficial in the more advanced forms of the disease and during convalescence. In some form animal substances are necessary in every stage.

Like all other obstinate diseases, cholera infantum, is not without its specific remedies. In succession, alkalies, quinine, the stronger mineral acids, nitrate of silver, acetate of lead, oil of turpentine, etc., have been reported as invaluable in the treatment of this disease; some of them administered for the accomplishment of a definite object, and some, apparently upon no medical principles whatever. When given as specifics, they have all in their turn disappointed the practitioner, and the necessity of less reliance on the reported efficacy of some one agent, and of more upon the indications of a correct theory, becomes more evident in proportion to a more extended experience in their employment. It is by no means intended to question the accuracy of the statements made as to the success of these various articles; but the numerous failures in other hands, show clearly that the different modifications of the disease in different places, or the use of the remedy under other conditions of the system than that in which it was successfully employed, such, for instance, as a different stage of development, have doubtless been the reasons for want of success of a medicine which perhaps has been so much extolled, as to convey the idea that the remedy for the disease was at last discovered. The use of astringents is generally indispensable, but an exclusive reliance on them will certainly eventuate in failure; such remedies also as are applicable to an ulcerated condition, would be positively injurious under any other circumstances.

The success, therefore, of a specific agent is not to be referred to the power it possesses over the disease, like that of



an antidote to a poison, but to its adaptation to the morbid condition existing at the time; hence its failure under a different state of the system in the same disease.

The action of the known causes of the disease, and the morbid condition produced by them, are to be our sole guides in its management. The modifications in the general phenomena in a protracted case, the predominance of some symptom tending to divert the attention from the comprehensive view necessary always to take of the disease, and the complications which arise, will indeed tend much to embarrass the practitioner in his judgment, and to lead to a vacillating mode of treatment. But while these untoward symptoms are duly estimated and judiciously met, the main pathological condition and characteristic development of the disease must always be kept in mind, that we may not be induced to rely too much upon auxiliary remedies.

*First Stage.*—When the diarrhœa peculiar to teething infants becomes inordinately copious and frequent at the season when cholera infantum prevails, it is our habit to regard its probable termination in that disease. If there are evidences of acidity in the primæ viæ, it is best to neutralize it by some fixed alkali. Soda or potass appears often to exert a direct sedative influence on the gastro-intestinal mucous surface, and thereby equalizes and lessens the excessive peristaltic motion of the bowels; perhaps this effect is produced by simply neutralizing the acid which stimulates the affected part. The bicarbonate of soda combined with gum arabic and sugar,—about one-twentieth part of the alkali,—makes a good form to administer an alkali to a young infant. If this should fail to control the discharge, the carbonate of lime, in the form of chalk mixture, may be used. It sometimes happens that chalk, like other alkalies, will form with the acid in the stomach a purgative salt, and the discharges will be thereby increased. When this is the case, or if the diarrhœa is in no degree controlled, the mild vegetable astringents may be used. They may be freely employed, provided there exists no febrile action nor any heat of the abdominal surface. The

root of the common blackberry, *Rubus villosus*, or the root of geranium *maculatum*, or the bark of the white oak, *Quercus alba*,—in the proportion of half an ounce to a pint of milk, made into an infusion by boiling, is a convenient form for their administration. To an infant of six months, a teaspoonful may be given five or six times a day; a desert spoonful to a child of two years, at the same time using frictions with stimulating substances over the liver. Whenever it is attempted to arrest any copious discharge from the bowels, it is important to establish by such means some cutaneous revulsion by the use of a simple stimulating embrocation. At the same time the gums should be examined, and if found to be swollen, freely cut. Such is the mode of managing too excessive a diarrhœa from teething.

When there is reason for believing that the affection will result in cholera infantum, the discharge exhibiting less the presence of bile, frictions with mercurial ointments may be advantageously used, with or without the addition of powdered camphor, which need not be employed if any stimulating application to the skin has been previously used.

In mild forms of cholera infantum, we think the Hydrargyrum cum creta is a useful medicine, when it is deemed advisable to resort to the mercurial management. Objection has been made to it on account of its alleged uncertainty of action; this, however, can only arise from its being carelessly prepared, which may also be the case with any other compound medicine. It may be prescribed with advantage in doses of five grains every two or three hours, either alone or combined with Dover's powder and carbonate of magnesia, guided by the presence of abdominal pain or of excessive acid.

R. Hydr. c. creta 3 ss.  
 Pulv. ipecac. comp. ℞j.  
 Magñ. carb. gr. xv.  
 M. Divid. in pulv. xij.

One of these powders to be given to an infant once in four or six hours. If these should completely arrest the alvine



discharges, an enema ought to be given, and at least one passage secured in twenty-four hours. If vomiting be present, the Dover's powder may be omitted.

Dover's powder is often useful early in the disease; its employment being indicated when there exists much fever and pain in the bowels. The addition of a warm bath before prostration has commenced, will soften the cuticle and cause a dilatation of the cutaneous exhalants, and a diaphoresis will, almost of necessity, follow its use.

When the disease is fully formed, mercury becomes indispensable in its management, and the best form is calomel. It should not be given in large, purging doses, which only irritate the mucous membrane, while it passes off without producing any other effect than increasing the secretion which it is one object to restrain. From the twelfth to the eighth of a grain should be administered every two, four, or six hours, intimately combined with some inert substance, as fine sugar. Medicines, it is well known, will often act with more efficiency when minutely divided; and calomel in this disease will be found to be far more effective in producing its specific action when carefully divided by being rubbed and well mixed with the purest sugar. The combination should be reduced to the finest impalpable state, and in this condition made into syrup with water. Calomel is especially useful in the first stage of the disease; at a later period, when the evacuations have become excessive, and inflammation and ulceration exist, it will pass with the evacuations, and produce no effects on the liver.

The use of opium in young children requires a great deal of cautious judgment. It is a very valuable remedy when judiciously given, and there is none so pernicious when indiscriminately used. At the commencement of the disease, it should never be employed.

One of the chief indications in the cure of the disease being to induce an action on the liver, and thereby relieve the congestion of that organ by a free secretion of bile, the calomel should be continued as the principal means of relief un-

til freshly secreted bile appears in the evacuations. Whatever be the other measures used in the course of the disease, the liver must be brought to its normal condition by this remedy. When a free circulation of blood from the intestines is secured, and the congested condition of the remote branches of the portal vein relieved, the disease then comes under control.

Such are the general measures the best adapted for the cure of cholera infantum, and are those which should be adopted in the onset of the disease, and, with occasional modifications, used throughout its course.

Some alteration may be required in the general course, or rather a suspension of the principal object may be necessary, from the appearance and persistence of some violent symptom which may itself very materially interfere with the proper use of the appropriate remedies, or become a source of severe and protracted irritation, and which it will be necessary to counteract by some special means adapted to the nature of the existing symptom.

Among the most obstinate symptoms in the first stage is vomiting, and while it continues incessantly tormenting the child, the administration of the proper remedies for the removal of the disease is of little avail; it therefore claims a large amount of the physician's attention.

For the control of this symptom a large number of remedies of the most opposite nature has been advised; all of them at times successful, and again not only useless, but frequently aggravating the symptom for the removal of which they were given.

The different anti-emetics advised in this disease are, 1st. The neutralizing, such as the alkalies. 2d. The neutralizing and astringent, as the alkaline earths in the form of lime-water or chalk mixture. 3d. Astringents; vegetable, as kino; mineral, as the acetate of lead. 4th. Anodyne; as opium. 5th. Stimulating; coffee, spirits of turpentine, ether, wine, brandy, etc. 6th. Revulsives and rubefacients, mustard, red and black pepper poultice, camphor as an embrocation, or

vesicatories over the gastric region, and stimulating enemata; and 7th. Remedies fulfilling the general indication for the cure of the disease; as mercury in various forms, either alone or in combination with others for the accomplishment of the same end; as calomel or blue pill with Dover's powder or prepared chalk. All of these have been recommended from experience in their use, but it is plain that they could only be successful from different conditions of the stomach at the time of their employment, and are not applicable to other cases where similar conditions do not exist.

Although vomiting, particularly when the disease is fully formed in the first stage, may be regarded as essential to the disease, yet it is evident, from the nature of the different remedies, that some difference must exist in the pathological condition of the organ which is its seat, and which can in general be ascertained by carefully watching the symptoms attending, and noting the state of the whole system, whether one of excitement or exhaustion.

At the beginning of the disease there appears always to exist acidity, and we invariably begin with some alkali; lime-water combined with milk rarely fails to arrest the vomiting at the expiration of two hours, when given every half-hour in the dose of one teaspoonful of the mixture, consisting of equal quantities of the two articles. Although at times readily arrested, it will recur, and will probably be arrested the second and third time. If the disease progresses it cannot be controlled by this simple means, other and more powerful measures will be required. Applications of a stimulating kind can then be used to the surface covering the stomach, but blistering should never be employed. Blisters appear to be always positively prostrating to young infants, particularly when applied to this part of the body. Revulsives by stimulating enemata will transfer the irritation; and if dysenteric symptoms appear, vomiting usually ceases; it rarely occurs when these symptoms arise early in the disease. Of the two, irritation in the rectum is to be chosen. Mildly stimulating

enemata, are important remedies in severe vomiting which resists other measures.

But it often happens that great exhaustion follows a severe and protracted vomiting, and stimulants are indicated and often receive the appellation of specifics, when it is simply the condition of the system that makes them efficacious, and whatever is the last employed is usually regarded as possessing anti-emetic properties. Strong coffee, or brandy, is among these, and under the circumstances just mentioned, highly useful in rallying the system and relieving the stomach by the general stimulation of the circulation.

Thus, by endeavoring to ascertain the actual condition, it may be in our power to control and manage to some extent this obstinate difficulty to the general management of the disease.

Instead of vomiting, tenesmus is at times the most distressing symptom, and is exceedingly wearing to the young infant. Irritation about the rectum is almost sure to relieve vomiting, and may therefore be but little interfered with; but when it passes into severe tenesmus, mild anodyne enemata should be used. They ought to be employed with great caution. The rule in the adult is, to give three times the amount of the tincture of opium by injection as it is usual to administer by the mouth. This rule is inadmissible when young children are treated. Children are peculiarly susceptible to the action of opium, although a most decided advantage often follows its use in the characteristically irritable condition of the system at this period of life; yet, from the great rapidity of absorption at that time, a small quantity cannot be given without incurring some risk. Let it be first given in an enema in the quantity which would be given by the mouth, and repeated if it should be returned, rather than increased in quantity. After a few trials, the quantity may be cautiously increased.

During the continuance of the disease, although free serous evacuations continue, the ordinary fæces are apt to be retained. This may be suspected when the abdomen becomes tumid, and the alvine evacuations have undergone no altera-



tions. If the mercurial preparations have failed to procure an evacuation of fæces, a laxative consisting of magnesia and rhubarb, will be proper to remove the highly irritating contents of the bowels. There is often acid existing in the stomach and bowels in this disease; for from the absence of bile no neutralization occurs, and dissections have exhibited the presence of a frothy, acid matter in different parts of the bowels. The combination, therefore, of some alkaline remedy will be called for by this probable condition. When there is no fever present, the aromatic syrup of rhubarb and magnesia will be found a useful prescription. The object being simply to relieve the bowels of the load of irritating fæces, such measures are indicated as will at the same time tend to produce a lessened flow of the serous discharge from the exhalent vessels of the mucous membrane.

As to the employment of astringents a great deal of caution is to be used, neither rejecting them, nor using indiscriminately such measures as will at once arrest the most prominent and exhausting symptom of the disease. Although astringent remedies are not to be regarded as the principal mode of cure, yet when the child appears to be rapidly sinking from excessive exhaustion produced by large serous evacuations, it will be advisable to employ some of those already mentioned, or others of a more powerful efficacy.

Whenever it has been deemed advisable to resort to the use of astringents, we have been in the habit of using them as auxiliary remedies, and, that their action may not be interfered with, to suspend for a short time the mercurial course. Tannin, either pure or as it occurs in kino and catechu, will often temporarily arrest the discharges. One of the most efficacious astringents is the acetate of lead, combined with Dover's powder in the proportion of the third of a grain of the former to the twelfth of a grain of the latter, to a child of fifteen months once every two hours. When the secretion of bile is established, there is nothing so well adapted to complete the cure as this combination. When using the stronger vegetable astringents, as kino or tannin, it will be

necessary to stop the animal gelatine which may have been used as diet ; or it will form with them an insoluble compound, and add to the existing disease the irritation of a foreign, indigestible article.

*Second Stage.*—The treatment of what we have called the second stage of the disease, is that which will be best adapted to remove the inflammation and ulceration of the affected parts. If the inflammatory period is early in its invasion, and appears almost simultaneous with the appearance of the disease, a leech to the verge of the anus will be advisable. If this should not afford relief, one or two may be applied over the region of the liver, or dry cupping may be used to the same part, according to the ability of the child to bear the depleting process. It is, however, exceedingly rare that the loss of blood is required,—the inflammatory or congestive stage appearing usually after a large loss of fluids has debilitated the little patient, clearly forbidding the use of sanguinary depletion. When these symptoms appear after some days, the most that the child can bear is dry cupping in different parts of the abdomen, followed by fomentations of warm water. It is well known to practical men that instances constantly occur where there exists local inflammation, and where it would be exceedingly rash to abstract blood ; this is especially the case in the disease under consideration.

In that state of the system which exhibits this affection with inflammatory action and fever, the mercury which is given may very advantageously be combined with Dover's powder. There is not much danger of exciting vomiting by its use ; for, as has already been remarked, when the disease is exerting its force on the intestines with an inflammation of these parts, there is but little disturbance of the stomach. Half a grain of Dover's powder, with the sixth of a grain of calomel, may be given every four or five hours. We have thought that there is less irritation to the mucous membrane in this stage of the disease, where the blue pill is substituted for the calomel.



It is in this stage of development especially, although useful throughout the disease, that we have found gelatine, either alone or combined with milk, highly beneficial in its management. It is so soluble as to be easily and entirely absorbed, and if it supply but partial nourishment to the wasting body, or if it be altogether what is denominated respiratory food, and indirectly prevents the oxidation of the tissues, yet it is especially an unirritating substance to the tender mucous surface, differing altogether, in this respect, from any of the vegetable mucilages or jellies, which, for the most part are undissolved.

Combined with this inflammatory condition is a greater or less ulceration, exhibited in the discharges already referred to, when speaking of the symptoms. It is in this state that the nitrate of silver is beneficial, and it is probable that it is under the same circumstances that sulphuric acid or creasote has been employed with advantage. The nitrate of silver appears to be well adapted to the ulceration of the diseased parts, and when judiciously used, is a very soothing and efficacious remedy to the inflamed parts. It may be given in the quantity of one-twelfth of a grain, with about one drop of the tincture of opium, three times a day.

*Third Stage.*—This is the period of complication. When the cerebral symptoms, such as congestion and stupor, appear, very little if any treatment is of any use. We have often resorted to the various modes of combating congestion of this organ at this period, and have as often failed in obtaining any relief. We regard, therefore, the symptoms marking this stage as preceding a fatal termination.

*The Chronic form.*—When the disease is greatly protracted, it becomes mixed in its character, and often attended with great prostration. In this chronic condition, the continuance of an astringent course, with a judicious use of tonics, becomes necessary. A close attention to the symptoms will be particularly necessary in this form, which partakes of the mixed character of a chronic diarrhœa, and may properly be denominated a sequel of cholera infantum.

This chronic condition will often continue without any very decided symptom of inflammatory action, at least to such a degree as to require direct anti-phlogistic remedies: an inflammatory irritation will exist, keeping up the morbid symptoms, and wasting the strength of the child by the constant discharge from the bowels. Under these circumstances, it will be necessary to resort to astringents, cautiously used, or to some of the stimulants which possess astringent properties, and which appear to exert some peculiar power on the mucous membrane. Nitric acid is a medicine of this kind, and in tedious cases will often act in a favorable manner by allaying the morbid action of the mucous membrane. Six drops of this acid, with six drops of the tincture of opium, may be diluted with an ounce and a half of water, of which a teaspoonful may be given once in three or four hours. When there is excessive relaxation an infusion of simarouba bark may be substituted for the water, and the mixture rendered slightly stimulating by the addition of the syrup of ginger or of oil of cinnamon, or a drop of the oil of cloves, rubbed up with sugar, and added to the mixture. In similar cases of atony, the sulphate of iron has been found useful in doses of one quarter of a grain three or four times a day. The tartrate of iron is also useful for the same object, that of imparting tone and astringing the parts. Ten grains may be dissolved in half an ounce of water, with the addition of one of the essential oils just mentioned; of this mixture, twenty drops may be given four times a day.

Throughout the whole of the chronic or secondary disease, debility is a prominent symptom; and while the discharges are restrained by appropriate remedies, whatever can impart tone by a proper stimulating influence should from time to time be used. One of the best we know of, is the compound tincture of cinchona, known as Huxham's tincture; the combination of the stimulating ingredients makes it peculiarly adapted to the restoration of the lost tone of the stomach and intestines. Tincture of kino, tannic acid, and other astringents may also be resorted to, with the addition of one of the

essential oils, as some stimulant will be, in most instances, required in the greatly relaxed and prostrated condition of the patient; the astringents scarcely acting of themselves. When alcoholic stimulants are needed, we always prefer brandy to wine, and always commence with brandy and water; if this agrees well with the child, we then combine the brandy with isinglass jelly, and if no untoward symptom arises from its use, change it for milk punch, as supplying the most nourishment. Often have we seen a child rally with surprising promptness when a little brandy has been given. The symptoms are so varied and so combined, that a great variety of medicines has been used to meet the different indications; most of them, however, of a tonic or stimulating nature, so modified by suitable combinations as to meet the peculiar circumstances as they arise. Other stimulants are of a specific character, and act directly on the mucons membrane; of this kind is the balsam of copaiba, which may be given in doses of three or four drops, twice a day. In this class, also, is nitrate of silver, already mentioned.

The instinctive desire for animal food at this time, is singularly craving, and may safely be indulged. Butter, fat salted meats, fresh meats abounding in juices, are eagerly seized by the child, and are, perhaps, the best stimulants that can be given—far more efficacious than those of a therapeutic nature.

In the management of this disease, our efforts must be chiefly exerted in its incipency, and during the stages when it still exhibits as its most marked phenomenon, the condition resulting from an excessive and morbid development of the parts which constitute and characterize the affection.

The transition from a healthy state in a young child to that of disease, is rapid, both from high nervous sensibility, and from the quick interstitial growth of parts. The effects of the exciting causes show themselves promptly; and early in the disease are simple in their manifestation, decided in their character, and with little or no complication. It therefore becomes a task promising more than ordinary results, to

examine well and thoroughly into the nature of the exciting agents, and their action on the economy of the system ; to learn, if possible, in what manner the diseased development is connected with the ordinary development of the affected parts.

Regarding the process of growth as a great predisposing cause of disease among children, we have endeavored to trace the diseased condition in cholera infantum from its commencement as a simple natural development, and to connect this development with the well-known causes which are active in the production of the morbid changes in the parts affected in the disease, and have thereby been enabled to present the subject in a strictly practical aspect. The preventive and hygienic measures for relief, so abundantly proved by experience, have their full explanation in the philosophical consideration of the subject ; while the same investigation bears directly to the establishment of the principles on which the therapeutic management is founded.

## APPENDIX.

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### A.

It is remarkable that Dr. Cleghorn should for the first time have made the discovery referred to, in Minorca, and also that on his return to Great Britain he should not have recognized the disease of which he speaks, if it was a peculiar affection in his country. His talent for observation appears to have been unequaled. Dr. Fothergill, in a letter to Dr. Cuming, August 14th, 1742, awards the following praises to him: "Thou wilt, no doubt, admire the industry of our friend *Cleghorn*, who situated in a corner of the world, has made greater progress than any of us who even do not want the proper aids of study. Let us, therefore, stimulate one another, that we may follow his footsteps, and become the worthy friends of so great a man." —*Mem. of John Fothergill, M. D., by John Coakley Lettsom, p. 104.*

Dr. Cleghorn's observations in Minorca embraced a period of seven years. In three of these he mentions the existence of "cholera morbus" among children, in connection with several other diseases. In the other four years no mention of such affection occurs. The following is his only account:

1744. "From the end of June, the young children (who constantly suffer first by excessive heat and cold) are attacked with vomiting, purging, and periodical fever."

1747. "About the end of the month [June], the cholera morbus carried off many children."

1748. "The ensuing summer proved very unhealthy to children, many of them dying of cholera morbus."

It would appear from this that the disease was not uniform as to the time of its invasion; and the remark in the last mentioned year, seems to convey the idea that it was an unusual season for sickness among children.

The following extract is from the remarks of Dr. G. R. B. Horner, of



the U. S. Navy, on the diseases of Minorca,\*made from observations during the period between 1831 and 1838, inclusive: "Dysenteric and other disorders of the alimentary canal prevail, but I am not aware that the former does to such a degree as to be called epidemic; and in this respect the climate seems to have undergone a material change since Cleghorn lived in Minorca."

## B.

The following table, taken from a paper by Drs. Niles and Russ, in the New York Medical and Physical Journal, v. 6, gives the number of deaths for eleven years of several prominent diseases, showing the influence of temperature on mortality in that city.

DISEASES.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Consumption,.....	660	659	644	664	616	519	591	663	579	588	645	656	7466
Acute Diseases of Lungs,.	200	292	254	250	210	114	117	105	92	141	152	172	2069
Fevers, .....	178	137	158	186	211	245	262	374	497	441	305	211	3205
Dropsies,.....	244	257	241	245	254	259	241	272	308	269	259	245	3044
<i>Cholera Infantum</i> ,.....	2	2	2	1	5	32	246	527	288	108	14	18	1245
Dysentery,.....	22	14	29	7	16	28	233	489	378	203	79	36	1544
Croup, .....	137	106	122	106	91	66	69	67	84	140	139	122	1239
Tabes Mesenterica,.....	68	66	85	95	97	69	80	126	139	135	89	84	1115
Gastro-enteritis,.....	48	54	56	60	60	76	121	97	94	69	67	39	861
Whooping Cough,.....	53	66	42	33	37	31	73	105	105	71	56	49	721
Apoplexy,.....	49	59	56	47	57	45	109	59	45	59	55	57	697
Measles, .....	48	42	46	45	32	49	65	77	45	34	24	45	552
Intemperance,.....	49	32	33	31	49	47	46	43	44	47	63	47	531
Disease of Liver,.....	48	46	34	35	34	39	57	44	36	64	41	50	528
Palsy, .....	42	42	44	31	28	28	31	38	25	41	39	44	428

## C.

The spring and summer of 1816 were remarkably cold. Various discussions appeared in the newspapers and philosophical periodicals, as to the cause. It was attributed to spots in the sun; to numerous ice-islands on the coast; and to the existence of a vapor which filled the atmosphere, "equally dense and yet diaphanous, all over the horizon, that existed at times in the atmosphere." This cold existed till the middle of June, with repeated frosts, which injured many wheat, rye, and corn fields in this and the neighboring States. In the latter part of June the temperature arose to 87°, but



again descended and continued to the 15th of July from 15° to 20° below summer temperature.\*

In the year 1816, there was frost on Long Island in every month of the year, and the corn was killed almost universally by the 5th of September.†

Numerous reports were brought in by vessels arriving at New York, of immense ice-islands in the Atlantic, near the coast. Up to the 1st of July thirteen *different accounts* of these were published in the newspapers.

The temperature of the city of New York when compared with that of London is very remarkable. In the former city the mean of the summer is 75° : of the latter 60°. The highest range in London is 82°, in New York 97°. It is said by some that the disease exists in London ; if so, it is certainly to a very limited extent, if, as we have seen, excessive heat is essential to its development.

## D.

The dreadful pestilence that raged in Athens appears to have been of malarial origin, and to have affected all living creatures at a distance from human habitations. The sheep died in solitude. Lucretius observes, that even the birds in the woods, which they never deserted, and the beasts near the streams of water, and in fields and pastures, died in excessive numbers,—

“Nec tamen omnino temere illis solibus ulla  
Conparebat avis, neque noxia secla ferarum  
Exibant sylvis : languebant pleraque morbo,  
Et moriebantur.”‡

“Hæc igitur subito clades nova, pestilientiaque,  
Aut in aquas cadit, aut fruges presidit in ipsas,  
Aut alios hominum pastus, pecudumque obatus ;  
Aut etiam subspensa manet vis aëre in ipso :  
Et, quom spirantes mixtas hinc ducimus auras,  
Illa quoque in corpus pariter sobere necesse est.  
Consimili ratione venit bubus quoque sæpe  
Pestilentia ; etiam pigris balantibus ægros.”§

In the year of Rome 290 a severe pestilential disease spread throughout the city and country, affecting equally men and beasts. “Grave tempus et forte annus pestilens erat urbi, agrisque, nec hominibus magis, quam

\* Med. Repository, 3 vol. New Series.

† History of Long Island by Henry F. Thompson.

‡ Lucretius, Lib. vi. 1217.

§ *Ibid*, Lib. vi. 1125.

pecori; et auxere vim morbi tenore populationis, pecoribus agrestibusque, in urbem acceptis."\*

Lancisi mentions that in the Roman States the epizootics are very prevalent, and exhibit much the same symptoms as malarious diseases do in the man. McCulloch refers to their existence in Hungary, St. Domingo, Guadaloupe, France, and Italy, to a great extent, in 1711, 1745, 1772, 1785 and 1795, and in other countries, among all kinds of cattle, flocks of sheep, and wild beasts and birds,—all from paludal miasms.

Barron Larrey, in his surgical memoirs, speaks of the havoc made on the cows and oxen during Napoleon's campaign in Italy from the effects of malaria, thus: "Les reseignmens que je recueillie auprès des habitans, les recherches aux quelles je me livrai, m'assurèrent que l'épizootie reconnaissait, pour principales causes, la mauvaise qualité des fourrages, l'état marécageux des pâturages, la chaleur excessive et prolongée qui avait succédée tout-à-coup à un printemps pluvieux et orageux. Les pluies d'orage avaient considérablement grossi les torrens, les rivières, et en avaient causé le débordement: une partie de ces eaux, après avoir nui aux récoltes, était restée en stagnation dans les lieux bas et enfoncés; ce qui avoit formé autant de marécages."†

"Animals which feed in marshes where these fevers prevail, are found to have diseased livers. In the town of Wolcott, Seneca county, where marshes and low lands abound, the hogs, when killed, are generally found with corroded livers."‡

## E.

The following remarks are from the report of the committee on the subject of the "Agency of the refrigeration produced by upward radiation of heat, as an exciting cause of disease." It also gives the amount of existing knowledge as to the immediate cause of the invasion of miasmatic diseases. "Most authors who have treated upon atmospheric influences to which persons are exposed, have confined their attention to the conditions of excessive moisture or malarious effluvia, the products of putrefaction. During the existence of such circumstances, according to our view, let any one be subjected to the chilling influences exerted through upward radiation from exposure during the night to the clear open sky, and fever of the specific character prevalent will be the result; or, in the absence of such epidemic

\* Tit. Liv. lib. 3, c. 6.

† Mem de Chir. Militaire, tome 1, p. 165.

‡ Inaugural Dissertation on the Lake Fevers and other Diseases of the Genesee country in the State of New York. Edward G. Ludlow, 1823.

agents, diarrhœa, rheumatism, or other inflammatory affections may occur instead."

"In cities there is a compensation for the loss of heat through radiation. The walls and pavements absorb more heat by day, than they can possibly throw off at night. Hence the remaining heat prevents the detrimental effects of refrigeration from that partial radiation which alone can take place in cities. Persons can, therefore, go about at night in cities with almost as much impunity as by day, and this during the prevalence of epidemic influences which intrude themselves no farther than the precincts."

## F.

Two long articles are in the Evening Post of September 20th and October 1st, 1828, on the subject of the origin and extreme virulence of the miasm. The Long Island Star of the 18th of September of the same year, has the following editorial:

"*Malaria*.—The sickness which now prevails on Long Island, and which suddenly attacks whole families, is considered by some to be the malaria so well known in Europe, and which arises from heat, moisture, and the decay of vegetables. Its effect in some places has been dreadful indeed, and we trust will call forth the investigation of gentlemen of medical talent."

The following are from the New York Enquirer of the same year: September 2d—"In several parts sickness has made its appearance in the shape of fevers, &c. Long Island particularly groans heavily, notwithstanding its proximity to the sea." October 3d—"It is very sickly on Staten Island, many families suffering for want of medical aid."

Journal of Commerce, October 3d, 1828:—"The epidemic fever, both intermittent and remittent, which has been mentioned as prevailing in some parts of Long Island, still continues, and has increased of late, particularly in the vicinity of Newtown, Bushwick, &c. It is probable that it will continue unabated until we are favored with frost, that sovereign antidote to autumnal fevers. This city has enjoyed unusual health, and many families that moved into the country from fear of sickness precipitately returned. Our bills of mortality show that the number of deaths has fallen below the average of years. It is a little remarkable, too, that all the cases of bilious fever of obstinate character which have occurred in New York, have been contracted in Long Island and New Jersey or neighboring country."

In that year, it is stated in the "*Statistical report on the sickness and mortality in the army of the United States*," that malarial diseases prevailed very extensively around Fort Hamilton, L. I. "The laborers employed in 1828 in the erection of this post—a locality which had been previously exempt from the effects of malaria—suffered greatly from intermittent and remittent fevers. The elevated coasts of Long Island in the vicinity of the Narrows, where a case of intermittent fever was unknown in the memory of the oldest inhabitant, became so rife with intermittent and remittent fevers as to drive the inhabitants from their possessions.

## G.

By this table, made from the City Inspector's report, it will be seen what little influence was exerted on the mortality by cholera infantum by malarious epidemic of 1828, in the vicinity of New York. No remarkable sickness existed in any of the other years.

YEAR.	WHOLE NO. OF DEATHS.	DEATHS FROM CHOLERA INFANTUM.
1825 . . . . .	5,018	151 . . . . . 1 in 33
1826 . . . . .	4,973	222 . . . . . " 22
1827 . . . . .	5,118	238 . . . . . " 22
1828 . . . . .	5,181	161 . . . . . " 31
1829 . . . . .	5,094	119 . . . . . " 42
1830 . . . . .	5,537	168 . . . . . " 32
1850 . . . . .	16,978	713 . . . . . " 23
1851 . . . . .	22,024	721 . . . . . " 30
1852 . . . . .	21,601	915 . . . . . " 23
1853 . . . . .	22,702	922 . . . . . " 24
1854 . . . . .	28,568	1,525 . . . . . " 19

## H.

Extract from the report of the committee on the epidemics of Tennessee and Kentucky.

"*Cholera Infantum*.—This is a disease which has almost disappeared from considerable portions of this district, whilst it continues to prevail in other portions as much as ever. Notwithstanding much attention has been bestowed upon this disease in the United States, and especially in the west and southwest, it is doubtful whether the diagnosis is not even yet involved in some obscurity; *whether in fact, other diseases are not frequently called by that name.*"

"Cholera infantum usually begins early in the season, in May, for example, and frequently continues until October."\*

In the table already given in this Appendix, the entire number for eleven years reported for the month of May, is five, out of twelve hundred and forty-five for the whole period.

## I.

Extract from Emerson's Medical Statistics of Philadelphia:—"Bowel complaints, as the most destructive, stand first in this order (the mortality among children); of these about two-thirds are under the general designation of *Cholera*, nearly all of which were doubtless entitled to the specific appellation of *cholera infantum*, a disease almost peculiar to the United States, in many parts of which it exists endemically under the name of *summer* complaint. Of three thousand eight hundred and twelve, the whole amount of deaths reported from cholera, adults and children inclusive, three thousand six hundred and thirty-nine were under the age of puberty, and three thousand five hundred and seventy-six under the fifth year, viz.: two thousand one hundred and twenty-two under the first year, one thousand one hundred and eighty-six between the first and second years, and *only two hundred and sixty-eight* over the second year. As this affection seldom attacks them beyond the fifth year; the balance of two hundred and thirty-six, between the amount of that period and the total of all ages, may be counted as *cholera morbus*.†

## J.

The following, from "Essays Medical and Moral," etc. v. 2, by Thomas Beddoes, M. D., will sufficiently prove the fact that heat alone will produce affections of the liver: "I was informed by an officer from the spot, that nearly all the men belonging to a regiment of horse in India, died within a short space of time of a liver complaint, because the commanding officer would persevere in exercising them in the face of the sun." In the appendix to the same work are found remarks by M. Fitzgerald, Esq.: "A gentleman well known to have practiced long and very extensively at Madras." He speaks, "from much experience of the facts," and states that great mortality occurred among Europeans by reason of diseases of the liver from heat, especially among a detachment which joined Lord Cornwallis' army in 1790, which

\* Transactions of the American Medical Association, vol. vi. p. 333.

† American Journal of Medical Science, vol. i. 1827.



lost most of its men from this cause. He adds, that although intemperance may be a cause, yet "The natives, Dr. Beddoes may rely, sometimes suffer in very hot seasons, from acute inflammation of the liver without the assistance of intemperance, to which they are very rarely addicted." A very large accumulation of facts to the same point could easily be made, but these are deemed sufficient.

## K.

## DIET OF INFANTS.

*Extract from an article by the Author, published in the "New York Journal of Medical Science,"—July, 1844.*

The period of infancy presents to our attention circumstances in connection with diet, which have no parallel at any other time of life. In childhood and infancy the desire for food is frequent; capillary action, secretion, deposition, and interstitial increase, proceed with great vigor,—all, in consequence of this period being the period of growth; wherein it differs very essentially from the adult state,—as, in the latter, the action of vitality is comprised in the preserving and recuperative processes; to which is added, in the former, that of the development of the body. Growth is much greater during the first year; and the constant desire for food during that period is a circumstance of common observation. In young infants, the whole time is occupied with receiving nourishment and repose.

With this peculiarity of early infancy, there is also another more worthy of note, as it has a direct practical bearing on the subject before us; and that is in the fact that the food of all animals, in their earliest period of existence, is derived from animal substances,—even in those which afterwards subsist upon vegetable grains; the chick, even after being hatched, uses a part of the egg for its nourishment. Man, after infancy, obtains his nourishment from both animal and vegetable substances; and the great variety of articles of food makes a curious exhibition of his omnivorous nature,—the effect of custom, climate, religion, etc. The carnivorous propensities of the people at the extreme North, with their feasts of whale blubber, and the Indian Brahmin, with his meal of rice; the cannibal of the South Pacific Ocean, and luxurious tables prepared by the most scientific French cuisinier for the civilized convivialist; the oak-bark bread of one nation, the flesh-feast furnished by dogs, rats, mice, of another;—or the snakes, lizards, caterpillars, locusts, worms, and other reptiles, of the

African negro; and even the meal of clay used by the Otomacs, as mentioned by Humboldt, certainly present a wide variety in the articles used for sustenance, without considering the minutiae of our daily food, to prove that man is omnivorous. But under all the circumstances of climate, whether in the frozen region of the North, or under the burning sun of the tropics,—of superstitious customs, or savage barbarity,—whatever be the circumstances influencing the character and quality of man's diet, there is for him in a state of infancy, but one kind of food—and that of an animal nature. Milk is his sole article of sustenance until the time when a change in his system takes place,—when a new arrangement of his organization requires him to seek his food among more varied substances, and to which his instinct invariably directs him. Comparative anatomy affords its evidence to the necessity of adhering to this one kind of food. The form of the infant's stomach is much more conical than that of the adult, and resembles in this respect the stomach of carnivorous animals; and the facility with which an infant vomits, or rather regurgitates its food, is analogous to the ease with which the dog or cat vomits whenever any thing is swallowed, even in an inconvenient manner. In the horse, rabbit, or hare,—animals altogether graminivorous,—the stomach differs very essentially in its form, resembling much more the stomach of an adult; vomiting can scarcely be excited, even with the strongest emetics. The nature of the infant's food may very rationally be inferred from this analogy.

If, therefore, nature has provided but one kind of food for the infant, a sudden change to substances essentially different in their nature must be injurious to a greater or less extent; this is a natural and direct inference from the facts already stated. In adults, where every species of food is used, an entire change, and a restriction to one course of diet, are always productive of important effects upon the general system; and where a scarcity of food has compelled large numbers of men to alter their food, and suddenly to adopt entirely different substances from what they were accustomed to eat,—as was the case in some parts of France, in the year 1817, when a failure of the crops obliged the inhabitants to submit to great transition, and to feed upon whatever vegetables could be found,—extensive disease and serious permanent effects are the results.

The influence of an entire alteration of food, from its powerful effects upon the system, causes it to be regarded as a measure of great value in the treatment of many diseases; and the change to vegetable food is not unfrequently an important remedial measure. In the adult, such a change is but the restriction of him to a class of substances that is natural to him, and which he can easily assimilate; and therefore does no violence to his physical nature. In the infant, on the contrary, the adoption of a vegetable diet is actually contrary to the arrangement of his digestive organs, and to the provision which is naturally made for his daily sustenance; and in the

diseases of the stomach and bowels, must, from the extra demand made upon them to assimilate substances foreign to their nature, add to the existing derangement. Acidity, flatulency, gripings, diarrhœa, and other symptoms of indigestion, are of very common occurrence in young infants; and indigestion is the most ordinary affection at that early period, showing how easily their digestion can be impaired. A very obstinate disease will sometimes arise in infants about the time of weaning, and particularly if the change from the bland food furnished by the mother be sudden; hence, the care usually taken to accustom the infant to a different species of food, by commencing feeding it some time before this period, and thus gradually accustoming it to the necessary alteration of diet. If this precaution is necessary to prevent injury where nature indicates that a different kind of food is required, how much more care is needed when greater injury is likely to arise on a sudden change, at a period when there is no such natural indication, and which it is so common a practice to disregard upon the invasion of any affections of the bowels. Immediately upon the appearance of these, arrow-root, tapioca or sago formed into jelly, rice or barley-water, is given, from the supposed bland and soothing qualities of these various articles, which, it is supposed, render them peculiarly applicable to the inflamed mucous membrane of the parts affected. Such is undoubtedly the case in the majority of instances in childhood and at adult age, but in infancy I very much question whether this course is followed by any other than injurious effect. I have watched carefully the influence of these substances for some years past, and am satisfied that the additional labor the digestive organs have to perform, in their attempts to assimilate an unnatural food, greatly aggravates the disorder of the bowels; and if they should fail in digesting the entire quantity, the remainder must be a foreign substance to the bowels, and thereby become an additional source of irritation. It is well known that vegetable food in general requires for its digestion more time and more energetic action of the digestive organs than animal food; flatulency and acidity are more frequent upon its use. Under ordinary circumstances, feculent nourishment passes much more quickly through the intestines than gelatinous, albuminous, or fibrinous food. It very often swells and undergoes some degree of decomposition, giving rise to the extrication of gas either in the intestines or stomach; and even when perfectly digested, hunger returns very quickly, whenever the patient is kept exclusively upon it. Some kinds of food are much more difficult to digest than others, and although there are a variety of circumstances in the individual which influence the alteration of sustenance taken into the stomach, yet the digestibility of food is very often affected by circumstances relating to the food itself. Thus, fixed oils and fat are slow of digestion, as is known to all dyspeptics; so also vegetable substances exhibit this indigestibility in a greater or less degree, when in a crude or raw state, or in a farinaceous or

any other artificial condition. If these effects are produced in the adult, for the reasons already mentioned, it must be much more the case in the infant; and many an instance of the obstinate perseverance of disease of these parts may be referred to the injudicious system of feeding during its prevalence.

It is a rare event to have the secrets of the digestive process revealed, and subjected to the test of actual experiment during life or on a postmortem examination. The former has been exhibited to us in the case of an adult, by Dr. Beaumont; and the well-known facts there elucidated have been considered of the most important character. Of no less value are the facts exhibited by postmortem investigations of children, made at Paris a few years since, by M. Natalis Guillot, for the purpose of ascertaining the condition of the contents of the bowels of such as died under the use of the ordinary diet of the hospitals. It is the custom at these and similar institutions, whenever an infant is sick to withdraw it from the breast, and to substitute for the milk some farinaceous substance made fluid by boiling; arrow-root, gummed rice water, or a thickened preparation of rice, known by the name of "*Crème de riz*," and other preparations of a similar nature, forming the diet of the sick infant. In the reported cases of the foundling hospital, and those for the reception of sick children, prescriptions of this nature form a very important part of the treatment, as will be seen by referring to the different treatises of French authors on diseases of children. The mortality in the French hospitals is very great; and opportunities are continually afforded for examination, in such numbers as to establish to a certainty almost any fact which requires the proof of anatomical demonstration. The attention of M. Guillot being directed to the changes which the food given to children underwent, and to the excessive mortality among them, he instituted a series of investigations in a number of cases of death, with special reference to the state of the contents of the bowels. He was struck with the uniform similarity; a jelly-like substance being present in the bowels, and in some instances lining both the small and great intestines. This was subjected to the test of the tincture of iodine, which produced an intensely blue color, thus proving it to be starch.

Here we have a direct proof of the deficiency of the digesting power; the articles given for food had passed through the length of the intestines, and had undergone very little change, and could only act as foreign and irritating substances. The almost entire suspension of the digestive process might indeed have occurred upon the use of any description of food; but when it is considered that a sudden change is usually attended with injury even in the adult; that vegetable substances are, under ordinary circumstances, more difficult to digest than animal; that the natural food of the infant is entirely dissimilar in its nature to what was at once substituted in the instances above mentioned; we might very reasonably expect to find a sus-



pension of the digestive powers a very serious aggravation of disease, and the results already stated.

From all the facts here given, it appears to be the most rational course to pursue, to preserve as much uniformity in the diet as the nature of the case and attending circumstances will admit. If in health, when the digestion is unimpaired, as we have seen food of an animal nature is the proper kind for the infant; in disease there can scarcely be any alteration to food of an entirely different kind, without incurring some risk. It is not my intention to assert that no alteration whatever is to be adopted, and because but one kind of food is provided for the infant, that it would be hazardous to depart from it under any circumstances; such a course would be to discard all sound theory, to abandon all attempts at controlling disease, and if fully carried out would reach even to the administration of medicine itself. While we avail ourselves of the plain suggestions of science and the accumulated experience of ages, let us so adapt them to the peculiar condition of a class of individuals as not to do a positive injury by their injudicious and indiscriminate application. The aged, the robust, the toil-worn laborer, the inhabitant of the city or of the country, the delicate female and the tender infant, all demand some modification in the application of the same universally admitted principles of medicine. In the case of infants we can, without removing them entirely from the breast, avail ourselves of the mild and unirritative effects of substances of the same nature as that upon which the infant feeds. One principal reason given for the adoption of vegetable mucilage, such as infusion of flaxseed, arrow-root, etc., is that it is a soft and soothing application to the tender and inflamed mucous membrane. Now if the same object can be attained by any substance that possesses the same bland qualities, and is also of the same nature as the infant's food, there will be no necessity for resorting to substances possessing such highly undigestible qualities as those of a vegetable nature. It is not that we may alter the diet from the compound aliment, milk; but to select from some simple alimentary substances, which it is deemed advisable to employ as medicinal agents, that which, from its essential composition, will be found more nearly allied to the nourishment which nature so abundantly supplies, and thus do no violence to the physical constitution.

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#### NOTE TO PAGE 300.

We have to add to the postmortem examination, two cases recorded by Dr. W. C. Roberts, in the *N. Y. Med. Gaz.*, Nov., 1841, one by Dr. J. A. Swett, one by Dr. Gross reported by Dr. W. Parker in the same journal, in the paper of Dr. Roberts, and one furnished to the author in MS. by Dr. J. L. Vandervoort. In all these five cases the mucous follicles were diseased; in three, the liver was abnormal; in one, reported healthy; and in one, that it appeared in this condition.









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